COLLEGE OF AGRICULTURE OF CALIFORNIA.

REPORT

OF THE

COMMISSIONER OF AGRICULTURE

FOR

THE YEAR 1874.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1875.

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ILLUSTRATIONS.

REPORT

OF

THE COMMISSIONER OF AGRICULTURE.

DEPARTMENT OF AGRICULTURE,
Washington, D. C., October 26, 1874.

SIR: It gives me great satisfaction to believe that the operations of this Department for the past year have served to awaken and greatly increase a spirit of improvement in the agricultural interest of the country. A territory so extensive as ours, possessing every variety of fertility and every diversity of climate which are congenial to the productions of the earth, and with a population whose habits, manners, customs, enjoyments, and wants differ as much as the climate in which they live or the countries from which they come, requires a supervision which shall adapt itself as much as possible to the appreciation of their condition, meet their wants, and make that provision for their necessities and improvement which their segregated situation will not allow that they should make for themselves. The isolated situation of the farmers affords them few opportunities of keeping step with the rapid march of the world's progress, and any aid which can be given them by this Department is as strongly marked as it is highly appreciated. For their benefit it has been the province of this Department to seek for the best seeds which the world can supply, to study their adaptation to the soil and climate of the country, and to put them into the hands of those who will make them profitable to the sections where they respectively reside. When any discovery is made in the method of cultivation or propagation, it is promptly communicated through the medium of a monthly publication. Many persons are always engaged in this and other countries in making experiments to improve seeds and plants as well as new methods of their cultivation, whereby the work of the farmer may be made more profitable; these are anxiously watched, and their results promptly communicated, and, when successful, availed of by extensive distribution. The counsel, advice, and information of the Department are cheerfully given to all persons who apply for them on any subject which pertains to the business of agriculture.

This Department has never been unmindful of the expression which Congress gave to its purpose to improve the condition of the agriculturist by the act of 1862, which made provision for the establishment of a college in every State of the Union, whereby he may obtain scientific knowledge, and thereby elevate his calling to that standard which will give him a place in the race of competition in which all the world is en-

gaged. I have taken much pains, by publications and otherwise, to promote this great object, because it cannot and should not be concealed that the purely literary institutions of the country are hostile to the success of what they please to call a "new education." Indeed, the president of one of the most distinguished of these institutions, and who is a representative man, at an educational convention at Elmira, N. Y., took occasion to condemn the entire policy of the national and State governments regarding scientific and industrial education. There is perhaps no employment on earth which so constantly brings into requisition the principles of science as that of agriculture, and the Representatives of the people can render no better service to the cause of humanity and universal prosperity than to educate the farmer; give him botanical knowledge of the germinating power and structure of the plant he cultivates, the physiology of the horse he drives, the geology of the earth he walks upon, and the chemical properties of the land he deals with; and who can tell the ultimate progress which agriculture will make? The common schools of the country prepare the rudimental foundation upon which the colleges will build the scientific structure.

There is no incident which so cripples the operations of this Department as the want of the punctual publication of its Annual Report. For the last two years, the report has not been published. And while Congress, at its last session, apparently made the effort to order the publication of the Annual Reports of 1872 and 1873 for the use of Congress, in the opinion of the Public Printer it failed to attain its object. While I do not concur in this opinion, it is due to him to say that to print them involved a doubtful construction of the law, a responsibility which he was unwilling to take, and the reports for the use of members of Congress have not been printed. I regret this, because I believe it a matter of great political importance that these reports should go directly from the Representative to the constituent. It is one of the defects of our Government that it is too far removed from the attention of the people. In my judgment, it would be well if they were more frequently reminded that they had a Representative here who constantly cared for the interests of his constituents; that they had a part in the administration of the country; and it is not less worthy of remark that the Representative better knows who would appreciate this document so anxiously sought after. But, by a separate provision of the act, there was made an appropriation specially to this Department of $50,000 for the printing of the Reports of 1872 and 1873. These have been printed and delivered to the Department for its distribution, and which has served to relieve it from the obligation it was under to its correspondents at home and abroad. Both volumes being now in stereotype, I suggest that Congress may order them to be struck off for their distribution.

In making this my annual report, I cannot be unmindful of the approaching Centennial of the Independence of the United States. No such opportunity has ever occurred for such an exhibition of the progress which this country has made in its agriculture, its horticulture, its

manufactures, its commerce, arts, and sciences; its adaptation for war and the benefits of peace; whereby the people of other countries may be impressed with the capabilities of the nation, and our own made to feel proud that we have achieved so much.

By order of the President of the United States, a board has been constituted, whereby a requisition may be made upon the head of each Department to suggest what part it may take in this exposition. Anticipating that the Department of Agriculture would be called upon to respond to the inquiry what contribution it would make, I have so matured the subject as will enable me to answer when called upon. But I take this occasion to say that if the Departments do take part in this exposition, it shall be such a part as will do credit to the Government and its people. And to attain this, the Government should erect a building for itself, to be exclusively occupied by the several Departments.

The Statistical Division of this Department is the only point in the country where is concentrated reliable information as to the condition, prospects, and results of the cereal, cotton, and other crops, by the instrumentality of four correspondents in each county of every State; this information is gathered at stated periods of each month, carefully studied, estimated, tabulated, and published for the benefit, as well of the farmer and planter, as of the merchant and manufacturer who deal with their products; whereby all legitimate parties are protected from the rapacity of the speculator, who deals most profitably upon fabricated reports. When we consider the sources of this information, composed of thousands of minds of various shades of sanguine and dispirited temperament, and of extensive and limited knowledge, and when we add to this the varying seasons of heat and cold, wet and drought, the degree of accuracy which characterizes the estimates of final results is truly wonderful. Such is the effect produced by this information upon the markets of the country that it is most carefully guarded up to the moment of its publication to the world at large.

By the action of the last Congress, about four acres of ground, formerly occupied by the canal, have been added to the Department grounds, and are now undergoing preparation to form a part of the arboretum, which for some time past has been in the process of formation in the grounds surrounding the Department building, which has greatly attracted the attention of visitors who are interested in the growth of trees and shrubs, either as useful cultural products or as subjects of decorative ornament. It is gratifying to know that the desire to possess and preserve the most beautiful forms of our arboreal vegetation is rapidly increasing.

The demand for semi-tropical fruits for experiment in the Southern States is very great, much beyond the ability of the Department to supply, although every effort is made to do so. The Chinese tea-plant is especially in demand, and many thousands of young plants have been distributed during the past year. The chief difficulty in the way of rendering this culture a commercial success is in the cost of labor for the

proper manipulation and preparation of the leaves; but, as it becomes known that much of the supposed necessary operations can be dispensed with by substituting improved methods of curing, we may expect that the culture of this plant may increase over the very large portion of our country suitable to its growth, at least to the extent of a domestic supply.

The collection of exotic, utilizable, and economic plants is gradually increasing both in number and value. The orange-family is particularly valuable, and the best commercial varieties are propagated and distributed to the greatest practicable extent.

There has been no period in the history of this country when farmers' crops have been so extensively depredated upon as in the past year, and this has brought into active exercise the knowledge and industry of the Entomological Division of the Department. There is an increasing demand for information with regard to insects injurious to vegetation, and much pains has been taken to investigate the character of insects sent here, to point out their modes of infliction and the means by which their depredations may be avoided. And for those who seek to prosecute the study or acquire the knowledge of these insects, specimens of their injuries and nest-architecture have been arranged and exhibited in the room provided for that purpose.

To model and thus exhibit the fruits of this country is, perhaps, one of the most interesting and useful branches of the work of this Department. Here will be found specimens of fruits and vegetables as they grow in the various climates and soils of our country. Here the horticulturist may see what is and what is not adapted to his locality, and may thus select what is most profitable. The collection of fruits in this division is probably now the best in the world. By it facilities are afforded and valuable information given to fruit-growers showing how certain varieties are subject to great modifications of appearance and quality by their growth in different parts of the country, while others are persistent in their character. Skilled judgment is required in the selection of the specimens, whereby these *fac similes* may be used to identify fruits whose names are lost or unknown.

During the past year, the work of the Botanical Division has been steadily prosecuted. The plants collected by the expeditions of Lieutenant Wheeler and Professor Hayden have been transferred to this Department by the Smithsonian Institution, and have been appropriately cared for.

The following additional contributions to the botanical collection are acknowledged:

1. A valuable set of the plants of Southern Utah, collected by Capt. F. Bishop, of Salt Lake City, among which plants are two or three new species.

2. A package of plants collected near Mobile, Alabama, by Mr. William Harvey.

3. A large package of the plants of Southern Indiana, made by Mr. Coulter, of Hanover, Indiana.

4. A small package of Colorado plants, from Mr. H. N. Patterson, Oquawka, Illinois.

5. Through the Smithsonian Institution, six packages of the mosses of Central Europe, from Mr. Paul Reinsch, of Germany, containing specimens of the minute species mounted for the microscope, and also illustrated by magnified figures.

6. Through the Smithsonian Institution, a package of Illinois plants, comprising about eight hundred species, from Dr. Fred. Brendel, Peoria, Illinois.

7. Through the Smithsonian Institution, a collection of plants, made by Mr. J. A. Allen, in Dakota and Montana, on the Yellowstone expedition, General Stanley commanding.

8. Through the Smithsonian Institution, six boxes embracing about one hundred specimens of models of German fungi. These models have been mounted on stands and placed in the museum, where they are objects of interest and value.

9. A very fine collection of the plants of Southern Utah, made by Mrs. E. P. Thompson, and by her presented to the Department. This collection embraces a number of the new species recently described by Mr. Sereno Watson; many of the others being rare and valuable.

From these various collections, the Botanist has made such selections as were desirable for the perfection of the herbarium, and they have chiefly been mounted and incorporated in their proper places, in order that the herbarium may, as soon as possible, contain a complete representation of the plants of the United States.

A large portion of the duplicate plants have been carefully prepared in packages and distributed, first, to foreign societies and individuals who have made contributions to the herbarium; and, secondly, to home scientific societies and institutions of learning, as follows:

Two packages to Prof. Paul Reinsch, Zweibrücken, Germany, containing 305 species.

Two packages to Dr. Francis Lagger, Freiburg, Switzerland, containing 261 species.

One package to Dr. K. Keck, Schwertzberg, Upper Austria, containing 215 species.

One box to the St. Petersburg Imperial Academy of Science, containing 656 species.

Two packages to the University of Virginia, containing 300 species.

One package to the Philadelphia Academy of Science, Philadelphia, containing 188 species.

One package to the Agricultural College of Tennessee, containing 207 species.

One package to the Indiana Normal School, Terre Haute, Indiana, containing 187 species.

One package to the Rockford Female Seminary, Rockford, Illinois, containing 239 species.

One package to the Chicago Academy of Sciences, containing 244 species.

One package to the Illinois Industrial University, Urbana, Illinois, containing 157 species.

One package to the Massachusetts Agricultural College, Amherst, Massachusetts, containing 188 species.

One package to the Buffalo Academy of Sciences, Buffalo, New York, containing 278 species.

One package to the Baltimore Academy of Sciences, Baltimore, Maryland, containing 196 species.

One package to the Princeton College, Princeton, New Jersey, containing 116 species.

Also packages to the following individuals, chiefly in exchange for plants sent to the Department:

One package to Mr. W. M. Canby, Wilmington, Delaware.

One package to Mr. H. W. Young, Aquebogue, Long Island.

One package to Prof. T. C. Porter, Easton, Pennsylvania.

One package to Prof. H. H. Babcock, Chicago, Illinois.

One package to Dr. Fred. Brendel, Peoria, Illinois.

One package to Prof. D. C. Eaton, Yale College, New Haven.

One package to M. S. Bebb, Winnebago Station, Illinois.

One package to Mr. William Harvey, Mobile, Alabama.

Included in the above distributions are several special sets of the grasses and carices of Lieutenant Wheeler's expedition of 1873. Sets of the same, not included above, were also sent to Professor Gray, Cambridge; to the Royal Herbarium, Kew, England; and to the Imperial Academy of St. Petersburg.

Very gratifying letters of acknowledgment have been received from many of the societies, institutions, and individuals above named, showing their high appreciation of this work of distribution. There still remains a large quantity of duplicate plants, of which fifteen or more large packages will be ready for distribution by the 1st of January next.

Many inquiries of a botanico-agricultural character, from farmers, planters, and others, in all parts of the country, have received careful attention, and have been properly replied to. Many of these inquiries relate to grasses suitable for cultivation in the Southern and Southwestern States. Observations and experiments in this matter are now being carefully made by many individuals, which give promise to result in discoveries of great economic value to those portions of the country.

It is believed that much valuable information of a practical character is both received and communicated through the medium of this division.

The Chemical Division of the Department has been busily engaged in analyses of natural fertilizers, vegetable products, and other materials which pertain to the interests of agriculture. Applications are constantly made from all portions of the country for the analysis of soils,

minerals, liquids, and manipulated manures to an extent far beyond the capacity of any one laboratory. The principle of action by which I must be governed is to limit these investigations to subjects which specially pertain to agriculture, carefully guarding against all opportunity to enable any one to use the Department and its investigations as a certificate for the sale of something else. The analysis of soils, except such as are sometimes found possessing some peculiar qualities, is of little use to any one whose farm of a single hundred acres would exhibit qualities of far different character. There is scarcely any soil in which those differences are not found in a very short space. The analysis of minerals, unless they possess fertilizing properties, or of wines, unless it be to protect the Government from imposition upon its revenues, or some other peculiar reason, is outside of the purpose of the Chemical Division of this Department, which is wholly occupied upon subjects which belong to the interests of agriculture alone. A more elaborate and detailed account of its work for the past year will hereafter appear in the Annual Report.

The Microscopic Division of this Department has been engaged during the present year in making original investigations, mostly relating to the habits of parasitic fungoid plants, which are frequently found on living plants and animals, producing sickly growth and in many cases premature death.

The following list embraces some of the leading subjects which have been examined: Black-knot fungus, (*Sphæria morbosa*,) a parasitic plant, which is the scourge of the plum and cherry trees of the United States; apple speck or rot of winter-apples in Eastern Arkansas; potato-rot; pear-tree blight; and cranberry-rot.

At the request of members of the National Pomological Society, made at its last annual meeting, held at Boston, Mass., last year, the Microscopist of the Department has made investigations of pear-tree blight, a disease which has been extending of late to an alarming extent throughout the United States, destroying in a few hours trees of the finest varieties.

The cranberry-interests of New Jersey and Cape Cod have been suffering to a large extent for several years past from rot of the berry while growing on the plantations.

The cranberry-growers of New Jersey have invested nearly $2,000,000 in that crop. It has been estimated that the loss of berries by rot sustained by one county last year fell little short of $100,000. At the earnest request of the Cranberry-Growers' Association of New Jersey, I sent the Microscopist of the Department to investigate the subject, and ascertain the cause of the premature decay, and to provide, if possible, a remedy. These investigations, it is believed, have been attended with successful results.

The president of the Cranberry-Growers' Association, at the last annual meeting, held in Bricksburgh in September last, in alluding to

these investigations, stated that they would effect a saving to the cranberry-growers amounting to hundreds of thousands of dollars.

There has been a healthy increase of the library in the past year. Two hundred and sixteen volumes have been presented by the authors; about 200 have been received in exchange for the reports of the Department; and 350 volumes have been bound, comprising foreign works and valuable pamphlets and periodicals.

The continuation of the exchanges of the reports of the Department with foreign societies seems desirable to all parties. By this means, the library obtains the reports of the leading agricultural, pomological, and meteorological societies of the world. The publication of the Annual Report for 1872 having been delayed, it was not sent out at the usual time, but will now be sent.

Of the numerous pamphlets presented to the library, those of permanent interest are classified and bound, as those on dairying, the fisheries, fertilizers, mining, &c. Those of a more miscellaneous nature are bound by States, indexed, catalogued, and lettered with the name of the State to which they refer.

The boards of trade of all the commercial cities of the Union have heretofore presented complete sets of their annual reports, and continue to send them as published. They are of constant use for reference. The annual reports of the various State boards of agriculture are also received as published. Of these, the library contains nearly complete sets for the last twenty years.

The accompanying tabular statement shows the quantity and kind of seeds distributed by the Department for the fiscal year ending June 30, 1874.

The operations of the Seed Division may be classed as follows: The *purchase*, *packing*, and *distribution* of seeds.

In the purchase of seeds, the Department has only patronized seed-growers and seed-firms proven reliable by experience, whose guarantee of good quality and genuineness cannot be questioned; and by receiving them from first hands has been able to procure them at much lower rates, and consequently in greater quantities, and is thus enabled to give more liberally to the many applicants who daily apply for seeds from all parts of the country, and to extend the benefits of the distribution.

The packing involves a vast amount of labor, and requires great care, to see that everything is put up true to name. The cereals and coarser seeds are packed in cotton bags, varying in size from one half-pint to one quart. It required 22,000 yards of cotton the past year to make these bags. The cotton was bought at the very lowest wholesale price, and the bags made in the Department, thereby saving a great amount of money, to be spent more usefully in the purchase of seeds.

The smaller seeds, such as cabbage, tomato, onion, &c., are put up in paper packets, which are also bought at wholesale. They are of four sizes, and their average cost is about $1 per thousand. It required 650,000 of these for the seed purchased during the past year.

In the distribution of seeds, a careful account is kept of everything issued by the Seed Division, with full address of parties to whom sent, and names of varieties as far as practicable, everything being charged to some account set forth in the accompanying tabular statement.

The Seed Division, having full lists of all regular correspondents and agricultural societies and having charge of this portion of the distribution with sufficient force to do the work, is enabled to make a very rapid and accurate distribution; and, since the transfer to the division of all clerical duties naturally belonging to it, the arrangement has proved to be of great advantage to the Department.

The tabular statement shows, by comparison with former years, a steady increase each year in the amount of the distribution, which is due to the manner of purchasing and economy in labor, and not to increased appropriations.

The distribution of so great a variety of seeds all over the country, embracing as it does all kinds of climate and soil, has brought into requisition the experience of one who has discharged this duty most acceptably to me.

Tabular statement showing the quantity and kinds of seeds issued from the Seed Division, Department of Agriculture, for the fiscal year ending June 30, 1874.

Names of seeds.	Number of varieties.	Senators and members of Congress.	Agricultural societies.	Statistical correspondence.	Meteorological observers.	Miscellaneous distributions.	Total.
		Packages.	*Packages.*	*Packages.*	*Packages.*	*Packages*	*Packages.*
Vegetable	242	203,083	100,462	104,850	14,330	355,594	778,319
Flower	193	120,798	2,100	....	4,175	205,808	332,881
Herbs	9	93	....	....	1,630	245	1,968
Tobacco	4	22,349	260	....	....	3,087	25,696
Opium-poppy	1	138	....	....	....	312	450
Tree-seeds	23	333	48	82	....	3,395	3,858
Cereals:							
Corn	2	986	6,272	1,632	....	1,358	10,248
Wheat	4	9,248	20,628	10,026	....	4,924	44,826
Oats	4	6,750	14,365	9,866	....	4,024	35,005
Barley	2	2,565	5,648	1,788	....	569	10,570
Rye	4	8,956	....	....	....	143	9,099
Buckwheat	2	362	4	2,220	....	120	2,706
Rice	1	6	....	....	....	102	108
Other field-seeds:							
Grass	17	4,451	7,706	3,548	....	1,877	17,582
Clover	5	1,072	994	209	....	1,033	3,308
Millet	1	18	....	....	....	11	29
Broom-corn	1	9	....	....	....	20	29
Sorghum	2	231	....	....	....	173	404
Sugar-beet	2	981	1,482	....	....	144	2,607
Mangel-wurtzel	2	930	1,482	....	....	141	2,553
Pease	1	443	556	459	....	235	1,693
Vetches	1	....	....	....	....	15	15
Tea-seeds	......	....	....	....	....	14	14
Textiles:							
Cotton	2	348	....	....	....	787	1,135
Hemp	1	104	16	....	....	16	136
Flax	1	....	....	....	....	7	7
Ramie	1	31	10	....	....	52	93
Jute	1	444	4	....	....	548	996
Total	......	384,729	162,037	134,686	20,135	584,754	1,286,335

The following statement exhibits in detail the financial operations of the Department for the fiscal year ending June 30, 1874:

Title of appropriations.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Salaries	$77,723 29	$76,924 00	$799 29
Collecting statistics	15,000 00	11,553 20	3,446 80
Purchase and distribution of seeds	65,000 00	64,904 89	95 11
Experimental garden	10,000 00	9,956 83	43 17
Museum and herbarium	2,000 00	1,942 02	57 98
Furniture, cases, and repairs	4,240 00	3,302 40	937 60
Library	1,500 00	1,259 10	240 90
Laboratory	700 00	690 49	9 51
Contingent expenses	12,900 00	12,008 85	891 15
Improvement of grounds	16,200 00	15,774 91	425 09
Postage	52,000 00	35,449 09	16,550 91
Printing and binding	20,000 00		
Total	277,263 29		

There is an unsettled bill against the Department on account of "collecting statistics," which will reduce materially the balance of that appropriation to be covered into the Treasury.

The large balance remaining from the appropriation for postage is owing to the fact that no annual reports were published for distribution last year; had the usual number been printed and distributed, it would have nearly or quite exhausted the excess.

The appropriations made by Congress for the current year will, with rigid economy, be sufficient to meet the ordinary expenses of the Department.

My estimates for appropriations for the fiscal year ending June 30, 1876, are based upon the actual necessities of the Department to insure its progress and success.

It affords me great satisfaction to say that the employés of the Department have constantly exhibited an earnest, faithful, and industrious determination to carry out my views of what the work of the Department should be to produce the greatest benefit to the greatest number of our people.

Respectfully submitted by your obedient servant,

FREDK. WATTS,
Commissioner.

His excellency U. S. GRANT,
President.

REPORT OF THE STATISTICIAN.

SIR: My tenth annual report as Statistician of the Department of Agriculture is respectfully submitted. The importance of statistical exposition in agriculture is conceded by all intelligent people who have given the slightest consideration to the subject; it is a work more difficult than similar labor illustrating other industries, inasmuch as it deals with capital associated by no ties of organization and with labor working in isolation through an area continental in extent and antipodal in variety of production. In mining, hundreds may be delving in a single pocket of ore under the direction of a single master who is also sole owner. In manufacturing, a million of capital and a thousand pairs of arms work together under one controlling mind, and the precise results in production are necessarily recorded with utmost care. In commerce, the merchant prince whose monthly sales represent millions of money furnishes an illustration of the concentration of capital, the association of labor, and the tabulation of every record of results. The farming class illustrates the adage, "Every man for himself," and, perhaps still more fully than in other industries, the selfish appendage to that saw of the solitary, "The devil take the hindmost." The farmer who grows cucumbers in Maine can have no practical partnership with him who cultivates cotton in Alabama. The crab-apples of Minnesota and the oranges of Florida cannot be grown together. The inundated planter of Louisiana and the farmer of Colorado do not entertain the same lively views of the necessity of irrigation. The stock-grower of the plains and the grain-producer of Illinois cannot agree upon the assumed necessity of protecting cattle against the depredations of the vicious cereals! There is infinite variety in the soil to work with, the climate to labor in, the crops to be grown, the means to accomplish ends, and in all the circumstances of the farmer; and the possibility of association, for the regulation of supply and protection against combinations to depreciate prices, as well as for mutual counsel and instruction, are reduced to a minimum by the isolation and distance which separates the scattered representatives of each of the thousand specialties in farming.

Exact statements of production are probably impossible in nine cases out of ten; indeed, books are not systematically kept by one farmer in a hundred. The United States census of agricultural production is founded upon estimates which are made from recollection of the crops of the previous year. The only advantage possessed by these over other estimates is that they individually cover smaller areas, and are made by persons most familiar with those areas; the principal disadvantage, the fact that the ignorant, and those fearful that the truth may increase taxation, are represented in these estimates equally with the intelligent and reliable.

What is then an essential prerequisite to accuracy and completeness of agricultural statistics? Manifestly, the education of all farmers as to the importance and individual economy of a precise and accurate knowledge of quantities grown, prices paid, rate of wages for labor, and other essential facts in every section of the country. The fountain-head of this information is at the farm; and ignorance, indifference, or opposition on the part of the farmer will vitiate the reliability and depreciate the value of all such information.

The amount of ignorance and wrongheadedness prevailing on this

subject is discouraging, although this is a period late in the nineteenth century. This country is far ahead of Europe in this respect, where obstacles to the collection of agricultural statistics are still deliberately opposed; but there are hundreds of thousands of our farmers, recent importations from the peasantry and tenantry of foreign lands, and many others of American parentage, who have not yet been emancipated from the bondage of their prejudices.

Unfortunately, the United States marshal has been employed in gathering data for the national census, and the assessor, the precursor of taxation, has generally been charged with such duty in the annual censuses of the few States that pretend to collect agricultural statistics. It is impossible to obtain the full truth in the face of this fear of taxation.

An obstacle was recently revealed, which, it is hoped in the interest of progress and enlightened policy, exists in few localities. One of our county statistical corps, in a neighboring State, has been repeatedly denied the assistance of neighboring farmers in making up his returns, on the ground that they were members of a secret order of husbandry, which had its own system of statistics, and did not wish the facts of production to be made known to the general public. Such narrowness is in positive opposition to the liberal and progressive views of the founders of the order, and proves the inability of such narrow-minded people to see clearly what is conducive to their own pecuniary interest as well as personal knowledge. It cannot be believed that this obstacle is otherwise than exceptional.

Were State laws for collecting annually these statistics wisely enacted and rigorously enforced, farmers would gradually acquire appreciation of the importance of statistics, and their experience would lead to more careful record and subsequent report. Such a system would furnish a most important adjunct to that of the Statistical Division of the Department of Agriculture. It is desirable, also, that all other agencies, organizations of specialists in production or manufacture, whether producers of grain, cotton, fruit, hops, flax, or other crops, should perfect their machinery for the collection of statistics, that all may be utilized, compared, digested, discrepancies accounted for, and all assimilated in a national record as nearly complete and accurate as all these sources of information, in addition to the extensive facilities of this office, can possibly make it.

There is no jealousy between the truly enlightened and unselfish laborers in this important field. Mercenaries, whose effort in statistics is a part of their commercial capital, are not expected to tell the whole truth, or to tolerate those who do. All honest statisticians desire the fullest co-operation of all who can reflect a ray of light upon this subject. They hail with pleasure any auxiliary organization that promises valuable results in any department of statistics. They desire, still further, the education of every individual producer as to the importance of accuracy in the presentation of primary facts, knowing that a summary of multitudes of inaccuracies can, by no effort of genius or industry, be made to express absolute verity. The press of the country should enforce the importance of precise records of fact by producers, and accuracy and precision of statement, instead, as is too often the case, of encouraging looseness, and, in many instances, reckless inaccuracy in the presentation of statistics. There must be more method, patience, and conscientiousness among the masses representing the primary sources of statistical data, or the efforts of the ablest and most faithful compilers of statistics and organizers of systematic collection will necessarily be impaired in efficiency.

As to a certain class of information, which can only be comparative and approximate rather than exact, such as the condition of crops at any given period, there should be more enlightened views in the public mind. There never was a time when estimates of the status of growing crops were unattempted, and it is certain that there never will be a day when they will be disregarded. We may say further that there never will exist such infallibility of judgment and such prescience of future contingencies that a statement of condition of any crop will inevitably prognosticate the exact return of the ultimate harvest. Such harvest does not even represent precisely the quantity actually matured, as there are always losses in handling, by decay from exposure, by insects and birds, or depredations by other forms of the animal creation; and these losses are by no means equal, but run by extremes in different years. These facts should be understood, and thus much absurdity of criticism might be avoided by superficial and thoughtless writers. At the same time, the opposite extreme, more foolish still, that a sweeping statement of insignificant data is as good as accurate averaging of the completest and most systematic information, should be avoided. There may be a very accurate and thoroughly reliable estimate of the status of crops, which will prove a valuable indicator of the harvest, but not without such modification as the vital or destructive forces of nature may occasion before maturity and accidents of harvesting and garnering may cause afterward. In other words, the distinction should be sharply marked between condition of the plant in growth and quantity of garnered product—things having the relation of parent and offspring, but by no means identical. The cursory and indefinite reports of growing crops in newspapers, which leave a confused impression on the mind, and often a doubt whether increase or decrease may be expected, are usually examples of unsystematic and careless statement, which can be vastly improved upon. The newspaper crop-report is an individual expression, oftener than otherwise, of a villager rather than a farmer, in form as variable as the individuality of reporters, without reference to any standard of comparison, one with another, and without any certain means of exact interpretation. Thus, if one is indefinite in quantity and proportion, one hundred equally indefinite only make a chaotic aggregate. For example, from a long list of such reports, which cost heavily in "enterprise" and money, to calculate the acreage of a crop from its details of comparative area. "The number of acres is small;" but the percentage of decrease may be 10, 30, or 50. "There is a great deal of corn planted," yet one must have a new "deal" before the winning card of ascertained acreage is secured. There has been "an increase in the number of acres;" but no one can say whether it is large or small. "More than usual has been sown;" however much "more" may mean. "Farmers have put all in the ground they can possibly manage;" which is the record of each recurring year, though circumstances greatly modify the mathematical import of "all." Some make exact comparisons; one returns one-half more than last year, another one-third, another still a quarter, but rarely is the comparison more closely drawn; it appears not to be worth while, if 33 per cent. shall seem a unit too low, to split the difference between that and 50; or, if the increase is evidently a few acres, it might be undignified to say less than a quarter, or at least 10 per cent. There are others who scorn to accept an increase less than the Dutchman's one per cent.; so, if the area is not "thrice" the former figure, it certainly must be "double." If the present condition of a crop is sought, the information conveyed by these random reports is equally indefinite. We quote from models:

"Farmers think they will have a good crop;" "Splendid prospects for corn;" "Wheat on dry land will exceed the average, on clays will be short;" "Rains are bringing corn along very fast." The reporter fails to indicate the amazing rate of speed at which the rains are leading the maize; and when he tells us that "the corn-crop will be heavy," we fail to see whether he expects it to weigh 70 pounds to the bushel, or yield 100 bushels to the acre. And if a full average is not expected, of course it is "half a crop," or, if unwonted nicety of comparison is attempted, three-fourths of a crop. The exaggerated and slip-shod expressions of conversation are carelessly penciled, and the precious information probably sent by telegraph. And this is enterprise and a model crop-report. This use of language, which has no common measure of value, and may mean one thing to the writer and another to the reader, is not the only difficulty with these unsystematic reports. The ground covered by the report is equally indefinite; usually a township, often a county, sometimes a wide district is ambitiously included when any territory whatever is indicated. If a township, the increase stated at 50 per cent. may be correct, and yet the whole county have actually no increase, as has been tested in our recent experience. Then a third difficulty occurs in the different production of different counties, some of which produce a crop by millions of bushels, while others in the same State fail to yield as many hundreds of thousands. Thus, with no definite expression of acreage in the separate reports, and these reports covering unknown areas of territory, or widely different in size, and differing quite as widely in amount of production, it is simply impossible to calculate or formulate an expression of the average meaning of the sum of such reports. It is the sheerest guess-work to indicate from such data whether there is more or less than usual of a crop, unless the unanimity in one direction is almost absolute. The only thing to be done—the only thing that is done—is to read the whole jumble of conflicting matter, and leap rashly to a conclusion which shall embody the general impression made upon the mind. It is a blind trust in intuition—often so blind as to overbear the result of mathematical demonstration which establishes its unreliability.

With a sublime faith in the superficial, and the blindest acceptance of the intuitive, a sort of system of interviewing the crops has been seriously proposed, in lieu of our present mode of obtaining information. A commissioner is to pass to and fro, by rail, at the rate of thirty miles an hour, with occasional stops to wood and water; converse with the passengers, obtain such glimpses of growing crops as might be revealed between railroad-cuts and through forest-undergrowths; talk with such grangers as cultivate the socialities of railway-stations, and then fix an unalterable estimate of forthcoming production. Thus is statistical science made easy.

The system of crop-reporting adopted by this Department requires all reporters to accept the same basis of comparison and to express their judgments in the form of percentages of such unit, thus rendering it possible to combine mathematically and give accurate expression to these judgments, the area and usual production covered by each entering duly into the calculation. If this work is correctly done, there can be no fallibility in the result except that which attaches to the separate constituent estimates of reporters. It is a plan which is practiced by the German government in current reports of growing crops, and the same essentially as that recommended by the international congress of agricultural statistics at Vienna.

With reference to a census of essential facts of agricultural produc-

tion, it is earnestly hoped that an enlightened public opinion may be created that shall demand a more frequent national census, and also a similar annual census in each State. A few States have made a good beginning, at trifling expense and with valuable results; others making an effort have made failures from want of enlightened public opinion to enforce faithful persistency in officers, and from a lack of ability or disposition to report accurately on the part of the farmers themselves. Ohio has successfully taken the initiative; Kansas, starting late, threatens to distance all her sisters in the race; Massachusetts has made full reports of the products of industry, but not annually; Minnesota has made a good beginning; Iowa has heretofore taken a comparatively full agricultural census biennially; other States in the North have made beginnings; and, in the South, Georgia deserves great credit for vigor in pushing a system recently inaugurated. Will not the remaining States take steps for prompt and efficient work? A State official thus refers in a letter to the Statistician to one of the difficulties in the way of the present system:

Industrial statistics are obtained at the same time the property is assessed for the purpose of taxation; and it is almost impossible to disabuse the minds of producers that there is not some ulterior purpose of taxation in view; and therefore they evade interrogatories in regard to stock, crops, &c. There is a sprinkling of farmers all over the State who are opposed to the whole system of gathering and publishing to the world statistical matter in any form, and in some localities the opposition seems to be an organized one. The ground of this opposition is that the information furnished will be used by middlemen to the disadvantage of producers. They do not seem to appreciate that pork-packers, dealers in grain, and all others who stand between the producer and consumer, obtain full information of supply and demand through private sources, their own correspondents, upon which information their circulars are issued, prices based, and purchases made. Nor do they appreciate that, after the products of the country are gobbled and held for gambling, price-lists, based upon the same information and obtained through the same private sources, are fixed for the consumer.

In connection with the subject of national collection of agricultural statistics, and particularly as to the necessity of obtaining the area in crops, the following extract from a previous statement is given:

The means employed and lines of investigation undertaken in the countries of the globe which encourage systematic collection of agricultural statistics are of great variety, and the degree of efficiency attained is equally various. Specific investigations and independent research may be conducted irregularly by individuals. Societies often do successful work within their own organization; but general investigation, involving every portion of the territory of a country, can only command success with the aid of the dignity and authority of government. The European governments are very generally committed to some system of obtaining the *acreage* cultivated annually in the principal farm-crops, though not all of them. In this respect, they are in advance of our own, which has never included in census-laws a provision for this initial point in statistical inquiry. The agricultural census of Great Britain, which is annual, is almost confined to an enumeration of farm-animals and the establishment of the area of each crop. The quantity becomes a matter of estimate. In this country, we are left to guess the size of our fields and the rate of production, and only once in ten years do we venture to obtain a record of gross quantities. These quantities, in the case of cereals, may, and often do, vary 200,000,000 bushels in a single year. The census of 1860 made the corn-crop of the previous year 838,000,000 bushels; that of 1870 credited but 760,000,000 to the crop of 1869; whereupon short-sighted statisticians proclaim a great decline in the culture of maize. Such an assumption is utterly unfounded. Not only is the aggregate quantity increasing, but the ratio to population—bushels *per capita*—is certainly not decreasing in any marked degree. The crop of the year 1869 was considered a failure, when Illinois actually obtained 130,000,000 bushels, though expecting in the previous July fully 230,000,000. So, in wheat, the apparent increase from 173,000,000 to 287,000,000 bushels is deceptive in a less degree, and partially due to the exceptionally-increased yield of 1869. The need is imperative for a census at least every fifth year, and an agricultural census, embracing area and quantity and number of farm-animals, should be taken yearly. Agitation should be continued till the people, and the Congress that does their bidding, shall be educated up to a realization of such necessity.

INTERNATIONAL STATISTICS OF AGRICULTURE.—The adoption of some uniform plan for the collection of agricultural statistics by the governments of the civilized world is an imperative requirement of the age. The differences in weights and measures, in kind and comparative quantity of production, and in many other prominent points, are sufficient hinderances to uniformity and promptness in these statistical exchanges. The telegraph is destroying isolation, and education is overthrowing the barrier interposed by the confusion of tongues; and if there could be an agreement upon a few essential points, such as the area occupied in specific production, quantity and value of product, the numbers and value of the animals of the farm, and the current crop-prospects of each season in advance of maturity and harvest, great advantage would result to the producers, exchangers, and consumers of the world. It would give steadiness to markets, protect labor against the destructive forays of speculation, and prove a benefit to all honest and legitimate industry.

During the summer of 1873, at Vienna, Austria, there assembled the first international congress of agriculture and forestry, and a preliminary discussion of the questions presented led to decisions of which an abstract is here presented.

I. In regard to the measures to be taken for the protection of birds useful to agriculture.

The congress determined to petition the imperial and royal government of Austria to conclude treaties with other governments embracing the following points: 1. To prohibit the taking or destruction of insectivorous birds. 2. To designate an international commission of specialists, who shall prepare a detailed list of such birds as should be protected. 3. To prohibit the taking or killing of grain-feeding birds between March 1 and September 15. 4. To forbid the use of nets, snares, or bird-lime for the capture of birds. 5. To prohibit the taking of eggs or young of birds, or the derangement of their nests, except in the case of injurious birds specified by the international commission. 6. To prohibit the exposure for sale of any insectivorous bird, dead or alive. This prohibition applies to grain-feeding birds during the time in which it is unlawful to molest them, as well as to the nests and eggs of all birds not officially classed as injurious. 7. Special cases, in the interest of science, may be excepted from the operation of these rules.

II. Relative to what sections of agricultural and forest statistics, and to what methods of abstract presentation of facts, is it desirable that an international agreement take place, so as to obtain results capable of comparison?

The congress expresses the conviction that agricultural and forest exploitation, as now developed, cannot give statistical data sufficiently exact for comparison upon its actual condition and progress in different countries. The efforts of international statistical administration hitherto have been insufficient to meet this necessity, which can only be met by researches of specialists in the matter, and upon the basis of common agreement between governments. This agreement should fix the stand-point of investigation, and arrange a uniform programme, exposing clearly what should be the aim of the statistical abstracts and the meaning of the nomenclature adopted. The governments should be pledged to each other for the execution, as regularly as possible, of the programme, and for the intercommunication of the results obtained.

For this reason, the congress prayed the Austrian government to take the initiative steps to secure such an agreement between governments, and to expedite the organization of a system of agricultural and forest

statistics. It is recommended that a census be taken every ten years in all countries at the same time that the census of population is taken; that it should comprehend the greatest subdivision of administrative districts, and especially the segregation of the most important agricultural regions; the area covered by agriculture and forest-culture in general; the cultivation of the most important crops, and their medium yield, calculated upon the largest possible number of years; the systems of culture in use; the superficies covered with different kinds of forest, and the mass of woods they contain; the aggregate of live stock, and the profit derived therefrom; the approximate number of great agricultural exploitations; the aggregate of rural population, &c., with a tabular summation of the whole.

This movement should result in publications showing clear and precise statements capable of comparison upon—

1. The market-prices of agricultural and forest products as well as the exchange to which they give rise. These statements should be as prompt as possible, and as often as once a week in times of special interest.

2. The annual yield of crops in percentages of an average yield, for the earlier crops in September and for the later ones before the end of November. These should be given in absolute figures by districts, and in totality as soon as possible after the period of production.

3. The prices of transportation by quantity and distance, by rail or other roads, or by water; the wages of laborers; interest on money; voluntary or involuntary mutations of property; the purchase-price and insurance of goods, &c. These statements should be made as far as possible from official data or other reliable information, and should be made annually.

III. Question A. What points of agricultural experiment demand the organization of an international system of observations?

Among the many points of this character, the following are specially recommended for international observation:

a. Examination of the amount of ammonia and nitrous acid precipitated in rain, with indications, as precise as possible, of the place and time of such researches. This involves the question of nitrogen.

b. Determination of the power of absorption of the soil by chemical and mechanical analyses, as well as the influence of fertilizers upon absorption.

c. Researches upon the scientific basis that should be given to agricultural hydrotechny, embracing gardens for hydrotechnic studies.

d. Analyses of the principal grains and seeds of different countries selected from different localities, showing their nutritive and commercial value.

e. Definition of the influence of nourishment and breed upon the quantity and quality of milk, and the capacity of animals for fattening.

f. Management of the feed, seed, cocoons, and eggs of silk-worms.

g. Essays upon the variation of plants from the same seed through the medium of different methods and conditions of culture—that is, of acclimation.

To accomplish the above-indicated labors, the governments are requested to complete the number of experimental stations and to furnish them with necessary means. The chiefs of experimental stations should assemble periodically with governmental delegates, to deliberate upon the works to be accomplished, the most eligible methods of procedure, and the publication of results.

III. Question B. What points of forest-experiment demand the organization of an international system of observations?

The congress decides—

1. Governments should by all means in their power introduce and organize forest-experimentation.

2. Chiefs of experimental stations should be specialists in this business, and, as far as possible, devote all their time and energy to their work; satisfactory results being obtainable only by the accumulation, without delay, of a large mass of observations, to be utilized in a way corresponding to forest-exploitation.

3. As soon as a system of forest-experiment is organized in any country, it should be placed in communication with similar systems in other countries, in order to act together upon points of international interest, as well as to determine the proper methods of action.

4. Questions demanding international observations relate to investigations of the influence of forests upon climates, the amount of rain-fall, the formation of springs, inundations, &c. This class of inquiries should be prosecuted at once, as the solution of the question of forest-preservation depends upon the information obtained on this subject.

5. A permanent commission should be constituted for deliberating upon measures suited to the development of forest-experimentation, with liberty to call in the aid of specialists.

6. The aid of different countries is invoked.

IV. What international measures seem necessary to remedy the ever-increasing devastation of forests?

1. An international effort has become necessary, especially for the preservation of forests at the sources of great water-courses, as their unlimited destruction brings about a fluctuation of water-levels very injurious to commerce and industry, filling the channels with sand, weakening the banks, overflowing the cultivated fields, and occasioning injuries affecting not only a single territory, but also other countries.

2. The preservation and management of forests, planted upon shifting sands, upon the summit and upon the declivities of mountains, upon the sea-shore, and other exposed places, is a matter of interest to all civilized nations; wherefore general principles should be established and put in force in all countries, binding upon proprietors of forests, the preservation of which is demanded by agriculture.

3. The preservation of forests being dependent upon good and sure management, especially in common forests, an international agreement is essential in order to make the researches, and to obtain communications in regard to existing arrangements in different countries.

4. The Austrian minister of agriculture is requested to confer with other governments in regard to the preparation of statistical reports, embracing the localities of the forests to be protected, their extent, character, &c.

The congress finally concludes that an international agricultural and forest congress, composed of delegates of governments and of great agricultural and forest associations, be convoked for the examination of legislative measures, facilitating the international exchange of agricultural and forest products, of finely-bred animals, of agricultural machinery, of artificial fertilizers, &c. The congress should also deliberate upon such scientific questions as will stimulate the progress of these great industries. The delegates should, at each session of the congress, report upon the international trade in alimentary products. The president should place himself in communication with governments and great agricultural and forest associations, in order to rally the force of these great interests to the statistical work contemplated.

THE CROPS OF 1874.

The winter of 1873–'74 was more favorable to fall-sown cereals than any of its predecessors for several years, giving a promise (which was fulfilled) of a crop relatively large and of high quality. The product of wheat was probably the largest aggregate quantity ever obtained in a single year, the estimate being 309,102,700 bushels. The rate of yield per acre was lower than usual in the spring-wheat States. The increase in wheat-production has been due entirely to enlargement of the area.

Corn in June was generally in fair condition, though a little late in the East; injured in bottom-lands in the South; and in some portions of the West by local droughts and the depredations of chinch-bugs. The season was cool on the upper Atlantic coast, and early frosts impaired the yield; the product of the South Atlantic States was good, and that of the Gulf States somewhat reduced. The reduction in the West was heavy, and the aggregate production less by 82,000,000 of bushels than that of the crop of 1873.

The quantity of rye comes very near to last year's aggregate, with a slight reduction in the area.

Conditions were unfavorable for a large crop of oats, the reduction from the previous figures being 30,000,000 bushels. The breadth sown was increased, but the apparent yield was reduced from 27.7 bushels per acre to 22 bushels.

Cotton, on a reduction in breadth of 10 per cent., lost in production about the same percentage; the local losses of condition by cold and inundation in spring and drought in later summer being compensated by exemption from insect-injuries.

Tobacco yielded less than half a crop; potatoes about the same quantity as in 1873; and hay about 4 per cent. less than the previous crop, with a rate of yield of 1.11 instead of 1.14 tons per acre.

Table showing the product of each principal crop of the several States named, the yield per acre, the total acreage, the average price in each State, and the value of each crop, for 1874.

Products.	Quantity produced in 1874.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
MAINE.					
Indian corn .... bushels.	809,000	24.6	32,886	$1 13	$914,170
Wheat .... do....	291,000	15	19,400	1 54	448,140
Rye .... do....	32,000	17.7	1,808	1 19	38,080
Oats .... do....	1,657,000	28	59,178	67	1,110,190
Barley .... do....	438,000	20	21,900	93	407,340
Buckwheat .... do....	396,000	22	18,000	77	304,920
Potatoes .... do....	4,600,000	123	37,398	54	2,484,000
Tobacco .... pounds.	....	....	....	....	....
Hay .... tons.	1,131,900	.88	1,286,250	13 13	14,861,847
Total	....	....	1,476,820	....	20,568,687
NEW HAMPSHIRE.					
Indian corn .... bushels.	1,239,000	36.4	34,038	1 12	1,387,680
Wheat .... do....	174,000	16	10,875	1 55	269,700
Rye .... do....	41,000	22	1,863	1 20	49,200
Oats .... do....	1,033,000	37.6	27,473	65	671,450
Barley .... do....	84,000	26	3,231	1 02	85,680
Buckwheat .... do....	86,000	20	4,300	62	53,320
Potatoes .... do....	3,400,000	120	28,333	59	2,006,000
Tobacco .... pounds.	180,000	1,275	141	20	36,000
Hay .... tons.	767,200	1.12	685,000	13 13	10,073,336
Total	....	....	795,254	....	14,632,366

Table showing the product of each principal crop, &c.—Continued.

Products.	Quantity produced in 1874.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
VERMONT.					
Indian corn ....bushels.	1,660,000	36.1	45,983	$1 10	$1,826,000
Wheat ....do....	418,000	17	24,588	1 43	597,740
Rye ....do....	61,000	16.5	3,697	1 06	64,660
Oats ....do....	4,151,000	37	112,189	57	2,366,070
Barley ....do....	112,000	28	4,000	1 01	113,120
Buckwheat ....do....	372,000	22.5	16,533	73	271,560
Potatoes ....do...	4,782,000	145	32,979	43	2,056,260
Tobacco ....pounds.	105,000	1,060	99	20	21,000
Hay ....tons.	973,500	1.14	853,947	11 80	11,487,300
Total	....	....	1,094,015	....	18,803,710
MASSACHUSETTS.					
Indian corn ....bushels.	1,431,000	32	44,719	1 10	1,574,100
Wheat ....do....	35,000	14.5	2,414	1 45	50,750
Rye ....do....	258,000	13.8	18,695	1 11	286,380
Oats ....do ...	751,000	36.2	20,746	67	503,170
Barley ....do....	112,000	22.3	5,022	1 02	114,240
Buckwheat ....do....	56,000	15	3,733	72	40,320
Potatoes ....do....	2,449,000	110	22,263	69	1,689,810
Tobacco ....pounds.	4,920,000	1,450	3,393	28	1,377,600
Hay ....tons.	523,700	1.17	447,607	21 40	11,207,180
Total	....	....	568,592	....	16,843,550
RHODE ISLAND.					
Indian corn ....bushels.	279,000	24.3	11,481	1 18	329,220
Wheat ....do....	....	....	....	....	....
Rye ....do...	20,800	17	1,223	1 16	24,128
Oats ....do....	142,000	30	4,733	73	103,660
Barley ....do....	24,000	26	923	1 12	26,880
Buckwheat ....do....	....	....	....	....	....
Potatoes ....do....	550,000	95	5,789	82	451,000
Tobacco ....pounds.	....	....	....	....	....
Hay ....tons.	95,600	1.20	79,667	24 66	2,357,496
Total	....	....	103,816	....	3,292,384
CONNECTICUT.					
Indian corn ....bushels.	1,687,000	30	56,233	1 17	1,973,790
Wheat ....do....	39,700	18	2,205	1 45	57,565
Rye ....do....	339,000	14.5	23,379	1 21	410,190
Oats ....do....	1,013,000	31.5	32,159	72	729,360
Barley ....do....	23,400	22	1,063	1 18	27,612
Buckwheat ....do....	124,000	16	7,750	91	112,840
Potatoes ....do....	2,727,000	105	25,971	72	1,963,440
Tobacco ....pounds.	9,030,000	1,250	7,224	32	2,889,600
Hay ....tons.	661,200	1.30	508,615	19 25	12,728,100
Total	....	....	664,599	....	20,892,497
NEW YORK.					
Indian corn ....bushels.	16,807,000	30	560,233	93	15,630,510
Wheat ....do....	9,161,000	15.6	587,243	1 26	11,542,860
Rye ....do....	1,834,000	14.1	130,071	92	1,687,280
Oats ....do....	30,302,000	32.8	923,841	57	17,272,140
Barley ....do....	6,463,000	21.7	297,834	1 17	7,561,710
Buckwheat ....do...	2,917,000	18	162,055	80	2,333,600
Potatoes ....do....	25,423,000	105	242,124	57	14,491,110
Tobacco ....pounds.	1,593,000	650	2,451	13	207,090
Hay ....tons.	5,291,800	1.30	4,070,615	13 10	69,322,580
Total	....	....	6,976,467	....	140,048,880
NEW JERSEY.					
Indian corn ....bushels.	9,397,000	35	268,486	82	7,705,540
Wheat ....do....	1,986,000	15.5	128,129	1 30	2,581,800
Rye ....do....	480,000	13.1	36,641	92	441,600
Oats ....do....	3,284,000	22.5	145,955	60	1,970,400
Barley ....do....	7,300	18	405	1 20	8,760
Buckwheat ....do....	267,000	14.1	18,936	88	234,960
Potatoes ....do....	2,919,000	70	41,700	78	2,276,820
Tobacco ....pounds.	....	....	....	....	....
Hay ....tons.	520,300	1.35	385,407	16 22	8,439,266
Total	....	....	1,025,659	....	23,659,146

Table showing the product of each principal crop, &c.—Continued.

Products.	Quantity produced in 1874.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
PENNSYLVANIA.					
Indian corn ....bushels.	35, 821, 000	32. 2	1, 078, 946	$0 76	$27, 223, 960
Wheat ....do....	16, 636, 000	14. 8	1, 124, 054	1 21	20, 129, 560
Rye ....do....	3, 250, 000	14. 3	227, 273	90	2, 925, 000
Oats ....do....	25, 607, 000	24. 6	1, 040, 935	59	15, 108, 130
Barley ....do....	437, 000	23	19, 000	1 00	437, 000
Buckwheat ....do....	2, 062, 000	20. 4	101, 078	85	1, 752, 700
Potatoes ....do....	9, 223, 000	84	109, 797	79	7, 286, 170
Tobacco ....pounds.	10, 500, 000	1, 150	9, 130	15	1, 575, 000
Hay ....tons.	2, 421, 900	1. 16	2, 087, 845	17 05	41, 293, 395
Total	....	....	5, 798, 058	....	117, 730, 915
DELAWARE.					
Indian corn ....bushels.	2, 841, 000	18	157, 833	70	1, 988, 700
Wheat ....do....	588, 000	11	53, 454	1 31	770, 280
Rye ....do....	10, 800	11. 2	964	75	8, 100
Oats ....do....	397, 000	21	18, 905	52	206, 440
Barley ....do....	1, 700	16. 8	101	1 00	1, 700
Buckwheat ....do....	1, 200	22. 5	53	80	960
Potatoes ....do....	163, 000	70	2, 328	72	117, 360
Tobacco ....pounds.	....	....	....	....	....
Hay ....tons.	34, 100	1. 10	31, 000	20 00	682, 000
Total	....	....	264, 638	....	3, 775, 540
MARYLAND.					
Indian corn ....bushels.	10, 032, 000	20. 5	489, 366	73	7, 323, 360
Wheat ....do....	5, 209, 000	10. 7	486, 822	1 22	6, 354, 980
Rye ....do....	271, 000	11. 5	23, 565	87	235, 770
Oats ....do....	2, 434, 000	16. 5	147, 515	55	1, 338, 700
Barley ....do....	10, 000	18	555	1 00	10, 000
Buckwheat ....do....	61, 000	18. 2	3, 351	82	50, 020
Potatoes ....do....	881, 000	50	17, 620	78	687, 180
Tobacco ....pounds.	16, 500, 000	610	27, 049	09. 5	1, 567, 500
Hay ....tons.	164, 300	1. 25	131, 440	17 63	2, 896, 609
Total	....	....	1, 327, 283	....	20, 464, 119
VIRGINIA.					
Indian corn ....bushels.	19, 082, 000	20	954, 100	64	12, 212, 480
Wheat ....do....	5, 672, 000	7. 8	727, 179	1 17	6, 636, 240
Rye ....do....	460, 000	10. 5	43, 809	79	363, 400
Oats ....do....	4, 587, 000	11. 5	398, 869	54	2, 476, 980
Barley ....do....	6, 300	12	525	95	5, 985
Buckwheat ....do....	40, 000	13. 5	2, 963	70	28, 000
Potatoes ....do....	1, 068, 000	68	15, 706	64	683, 520
Tobacco ....pounds.	35, 000, 000	550	63, 636	12	4, 200, 000
Hay ....tons.	166, 400	1. 05	158, 476	16 88	2, 808, 832
Total	....	....	2, 365, 263	....	29, 415, 437
NORTH CAROLINA.					
Indian corn ....bushels.	22, 186, 000	16. 4	1, 352, 805	72	15, 973, 920
Wheat ....do....	2, 878, 000	8	359, 750	1 38	3, 971, 640
Rye ....do....	334, 000	8. 5	39, 294	92	307, 280
Oats ....do....	3, 083, 000	12. 9	238, 992	66	2, 034, 780
Barley ....do....	3, 200	16	200	80	2, 560
Buckwheat ....do....	19, 500	14. 5	1, 345	58	11, 310
Potatoes ....do....	702, 000	75	9, 360	69	484, 380
Tobacco ....pounds.	8, 500, 000	330	25, 757	16	1, 360, 000
Hay ....tons.	104, 800	1. 25	83, 840	14 83	1, 554, 184
Total	....	....	2, 111, 343	....	25, 700, 054
SOUTH CAROLINA.					
Indian corn ....bushels.	10, 169, 000	11	924, 454	1 00	10, 169, 000
Wheat ....do....	579, 000	6. 3	91, 905	1 85	1, 071, 150
Rye ....do....	42, 000	7	6, 000	1 55	65, 100
Oats ....do....	715, 000	11. 5	62, 174	91	650, 650
Barley ....do....	6, 300	15	420	82	5, 166
Buckwheat ....do....	....	....	....	....	....
Potatoes ....do....	78, 000	70	1, 114	97	75, 660
Tobacco ....pounds.	45, 000	450	100	15	6, 750
Hay ....tons.	22, 400	1	22, 400	23 83	533, 792
Total	....	....	1, 108, 567	....	12, 577, 268

Table showing the product of each principal crop, &c.—Continued.

Products.	Quantity produced in 1874.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
GEORGIA.					
Indian corn.......bushels	24,494,000	11.1	2,206,667	$0 92	$22,534,480
Wheat.......do....	2,611,000	7.3	357,671	1 53	3,994,830
Rye.......do....	112,000	7	16,000	1 51	169,120
Oats.......do....	4,560,000	10.2	447,059	88	4,012,800
Barley.......do....	8,800	14.5	607	1 87	16,456
Buckwheat.......do....					
Potatoes.......do....	159,000	70	2,271	1 09	173,310
Tobacco.......pounds	291,000	580	502	13	37,830
Hay.......tons	17,500	1.10	15,909	22 33	390,775
Total.......			3,046,686		31,329,601
FLORIDA.					
Indian corn.......bushels.	2,112,000	10.6	199,245	99	2,090,880
Wheat.......do....					
Rye.......do....					
Oats.......do....	117,000	12	9,750	1 01	118,170
Barley.......do....					
Buckwheat.......do....					
Potatoes.......do....					
Tobacco.......pounds.	216,000	660	327	22	47,520
Hay.......tons.					
Total.......			209,322		2,256,570
ALABAMA.					
Indian corn.......bushels	20,228,000	12.3	1,644,553	93	18,812,040
Wheat.......do....	1,087,000	9	120,778	1 46	1,587,020
Rye.......do....	21,000	9.1	2,308	1 50	31,500
Oats.......do....	626,000	11.6	53,965	91	569,660
Barley.......do....	7,500	11.5	652	1 00	7,500
Buckwheat.......do....					
Potatoes.......do....	136,000	60	2,266	1 31	178,160
Tobacco.......pounds.	166,000	550	302	20	33,200
Hay.......tons.	15,300	1.05	14,571	17 50	267,750
Total.......			1,839,395		21,486,830
MISSISSIPPI.					
Indian corn.......bushels.	18,357,000	13.8	1,330,217	1 01	18,540,570
Wheat.......do....	275,000	9.2	29,891	1 75	481,250
Rye.......do....	14,000	9.4	1,489	1 61	22,540
Oats.......do....	639,000	14.5	44,069	1 02	651,780
Barley.......do....					
Buckwheat.......do....					
Potatoes.......do....	127,000	56	2,268	1 17	148,590
Tobacco.......pounds.	80,000	600	133	21	16,800
Hay.......tons.	13,000	1.25	10,400	21 09	274,170
Total.......			1,418,467		20,135,700
LOUISIANA.					
Indian corn.......bushels.	7,836,000	15.5	505,548	1 00	7,836,000
Wheat.......do....					
Rye.......do....					
Oats.......do....	28,000	12.3	2,276	1 08	30,240
Barley.......do....					
Buckwheat.......do....					
Potatoes.......do....	46,000	60	767	96	44,160
Tobacco.......pounds.					
Hay.......tons.	12,900	1.20	10,750	20 00	258,000
Total.......			519,341		8,168,400
TEXAS.					
Indian corn.......bushels.	28,016,000	19	1,474,526	75	21,012,000
Wheat.......do....	1,474,000	12.5	117,920	1 35	1,989,900
Rye.......do....	40,000	13	3,077	1 11	44,400
Oats.......do....	1,118,000	27.2	41,103	84	939,120
Barley.......do....	63,000	30.5	2,065	86	54,180
Buckwheat.......do....					
Potatoes.......do....	233,000	70	3,328	1 49	347,170
Tobacco.......pounds.	141,000	750	188	22.5	31,725
Hay.......tons.	62,000	1.40	44,286	10 92	677,040
Total.......			1,686,493		25,095,535

Table showing the product of each principal crop, &c.—Continued.

Products.	Quantity produced in 1874.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
ARKANSAS.					
Indian corn ....bushels.	9, 724, 000	12. 6	771, 746	$0 95	$9, 237, 800
Wheat ....do....	1, 177, 000	10. 5	112, 095	1 52	1, 789, 040
Rye ....do....	39, 000	12. 7	3, 071	1 37	53, 430
Oats ....do....	573, 000	15	38, 200	75	429, 750
Barley ....do....	....	....	....	....	....
Buckwheat ....do....	....	....	....	....	....
Potatoes ....do....	224, 000	43	5, 209	1 09	244, 160
Tobacco ....pounds.	708, 000	525	1, 348	15	106, 200
Hay ....tons.	10, 800	1. 12	9, 643	14 12	152, 496
Total	....	....	941, 312	....	12, 012, 876
TENNESSEE.					
Indian corn ....bushels.	31, 953, 000	16. 8	1, 901, 964	68	21, 728, 040
Wheat ....do....	11, 121, 000	9	1, 235, 667	1 06	11, 788, 260
Rye ....do....	238, 000	10. 5	22, 667	1 05	249, 900
Oats ....do....	3, 816, 000	14	272, 571	57	2, 175, 120
Barley ....do....	84, 000	20. 4	4, 117	1 12	94, 080
Buckwheat ....do....	76, 000	12	6, 333	74	56, 240
Potatoes ....do....	605, 000	50	12, 100	97	586, 850
Tobacco ....pounds	5, 780, 000	600	9, 633	10	578, 000
Hay ....tons.	114, 300	1. 10	103, 909	19 08	2, 180, 844
Total	....	....	3, 568, 961	....	39, 437, 334
WEST VIRGINIA.					
Indian corn ....bushels.	8, 803, 000	26. 5	332, 189	61	5, 369, 830
Wheat ....do....	3, 268, 000	11. 6	281, 724	1 00	3, 268, 000
Rye ....do....	268, 000	13. 1	20, 458	86	230, 480
Oats ....do....	1, 684, 000	16. 4	102, 683	53	892, 520
Barley ....do....	50, 000	18	2, 778	1 00	50, 000
Buckwheat ....do....	62, 000	17. 7	3, 503	81	50, 220
Potatoes ....do....	782, 000	76	10, 289	72	563, 040
Tobacco ....pounds	1, 690, 000	760	2, 224	14	236, 600
Hay ....tons.	167, 800	. 88	190, 682	16 37	2, 746, 886
Total	....	....	946, 530	....	13, 407, 576
KENTUCKY.					
Indian corn ....bushels.	48, 514, 000	25	1, 940, 560	55	26, 682, 700
Wheat ....do....	8, 525, 000	10. 6	804, 245	1 00	8, 525, 000
Rye ....do....	1, 095, 000	11	99, 545	92	1, 007, 400
Oats ....do....	4, 292, 000	14. 4	298, 055	55	2, 360, 600
Barley ....do....	257, 000	27	9, 518	1 12	287, 840
Buckwheat ....do....	3, 000	15	200	84	2, 520
Potatoes ....do....	955, 000	46	20, 761	99	945, 450
Tobacco ....pounds.	34, 500, 000	640	53, 906	12. 4	4, 278, 000
Hay ....tons.	253, 400	. 94	269, 574	18 22	4, 616, 948
Total	....	....	3, 496, 364	....	48, 706, 458
OHIO.					
Indian corn ....bushels.	88, 422, 000	36	2, 456, 167	58	51, 284, 760
Wheat ....do....	25, 993, 000	15	1, 732, 867	1 04	27, 032, 720
Rye ....do....	392, 000	12. 6	31, 111	81	317, 520
Oats ....do....	17, 317, 000	20. 5	844, 732	49	8, 485, 330
Barley ....do....	1, 182, 000	23	51, 391	1 10	1, 300, 200
Buckwheat ....do....	192, 000	12. 5	15, 360	90	172, 800
Potatoes ....do....	5, 500, 000	71	77, 465	86	4, 730, 000
Tobacco ....pounds.	13, 000, 000	720	18, 055	09	1, 170, 000
Hay ....tons.	1, 655, 600	. 90	1, 839, 555	17 82	29, 502, 792
Total	....	....	7, 066, 703	....	123, 996, 122
MICHIGAN.					
Indian corn ....bushels.	12, 689, 000	27	469, 963	65	8, 247, 850
Wheat ....do....	17, 341, 000	14. 2	1, 221, 197	1 08	18, 728, 280
Rye ....do....	228, 000	14. 6	15, 616	81	184, 680
Oats ....do....	8, 434, 000	27	312, 370	50	4, 217, 000
Barley ....do....	463, 000	17. 5	26, 457	1 15	532, 450
Buckwheat ....do....	298, 000	15. 5	19, 226	77	229, 460
Potatoes ....do....	7, 601, 000	87	87, 368	63	4, 788, 630
Tobacco ....pounds.	....	....	....	....	....
Hay ....tons.	916, 600	1	916, 600	15 60	14, 298, 960
Total	....	....	3, 068, 797	....	51, 227, 310

Table showing the product of each principal crop, &c.—Continued.

Products.	Quantity produced in 1874.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
INDIANA.					
Indian corn .... bushels	74, 624, 000	27	2, 763, 852	$0 51	$38, 058, 240
Wheat .... do....	23, 331, 000	12. 2	1, 912, 377	94	21, 931, 140
Rye .... do....	397, 000	14. 5	27, 379	77	305, 690
Oats .... do....	11, 628, 000	19	612, 000	44	5, 116, 320
Barley .... do....	539, 000	20. 6	26, 165	1 10	592, 900
Buckwheat .... do....	155, 000	14	11, 071	56	86, 800
Potatoes .... do....	2, 091, 000	60	34, 850	81	1, 693, 710
Tobacco .... pounds	12, 000, 000	460	26, 086	9. 4	1, 128, 000
Hay .... tons	803, 900	1. 13	711, 416	13 92	11, 190, 288
Total	....	....	6, 125, 196	....	80, 103, 088
ILLINOIS.					
Indian corn .... bushels	133, 579, 000	18	7, 421, 055	56	74, 804, 240
Wheat .... do....	30, 122, 000	11. 5	2, 619, 304	86	25, 904, 920
Rye .... do....	2, 036, 000	15. 4	132, 208	71	1, 445, 560
Oats .... do....	31, 824, 000	17. 5	1, 818, 514	45	14, 320, 800
Barley .... do....	2, 052, 000	17. 2	119, 302	97	1, 990, 440
Buckwheat .... do....	136, 000	13	10, 461	88	119, 680
Potatoes .... do....	7, 438, 000	55	135, 236	83	6, 173, 540
Tobacco .... pounds	7, 000, 000	780	8, 974	10. 5	735, 000
Hay .... tons	2, 232, 500	1. 20	1, 860, 417	10 49	23, 418, 925
Total	....	....	14, 125, 471	....	148, 913, 105
WISCONSIN.					
Indian corn .... bushels	15, 492, 000	28. 2	549, 362	63	9, 759, 960
Wheat .... do....	18, 436, 000	11. 5	1, 603, 130	83	15, 301, 880
Rye .... do....	1, 091, 000	13. 3	82, 030	78	850, 980
Oats .... do....	14, 335, 000	26. 2	547, 137	46	6, 594, 100
Barley .... do....	1, 151, 000	20	57, 550	1 00	1, 151, 000
Buckwheat .... do....	375, 000	15. 5	24, 193	62	232, 500
Potatoes .... do....	5, 956, 000	87	68, 460	49	2, 918, 440
Tobacco .... pounds	2, 250, 000	1, 000	2, 250	7. 5	168, 750
Hay .... tons	1, 164, 500	1. 10	1, 058, 636	10 07	11, 726, 515
Total	....	....	3, 992, 748	....	48, 704, 125
MINNESOTA.					
Indian corn .... bushels	7, 548, 000	31	243, 484	51	3, 849, 480
Wheat .... do....	21, 338, 000	13. 4	1, 592, 388	70	14, 936, 600
Rye .... do....	145, 000	18. 5	7, 838	59	85, 550
Oats .... do....	11, 135, 000	30	371, 167	44	4, 899, 400
Barley .... do....	954, 000	24. 2	39, 421	83	791, 820
Buckwheat .... do....	45, 000	14	3, 214	73	32, 850
Potatoes .... do....	2, 465, 000	70	35, 214	49	1, 207, 850
Tobacco .... pounds	....	....	....	....	....
Hay .... tons	....	1. 35	605, 778	5 10	4, 170, 780
Total	....	....	2, 898, 504	....	29, 974, 330
IOWA.					
Indian corn .... bushels	115, 720, 000	29. 2	3, 963, 014	43	49, 759, 600
Wheat .... do....	33, 908, 000	11. 6	2, 923, 103	65	22, 040, 200
Rye .... do....	485, 000	17. 2	28, 198	63	305, 550
Oats .... do....	19, 650, 000	30	655, 000	38	7, 467, 000
Barley .... do....	4, 725, 000	20	236, 250	77	3, 638, 250
Buckwheat .... do....	107, 000	13. 2	8, 106	73	78, 110
Potatoes .... do....	4, 806, 000	63	76, 286	50	2, 403, 000
Tobacco .... pounds	....	....	....	....	....
Hay .... tons	1, 747, 200	1. 22	1, 432, 131	6 47	11, 304, 384
Total	....	....	9, 322, 088	....	96, 996, 094
MISSOURI.					
Indian corn .... bushels	46, 049, 000	16	2, 878, 062	74	34, 076, 260
Wheat .... do....	15, 385, 000	13. 5	1, 139, 629	83	12, 769, 550
Rye .... do....	454, 000	14. 7	30, 884	69	313, 260
Oats .... do....	13, 319, 000	22	605, 409	47	6, 259, 930
Barley .... do....	226, 000	18. 2	12, 417	1 07	241, 820
Buckwheat .... do....	25, 000	13	1, 923	69	17, 250
Potatoes .... do....	2, 022, 000	40	50, 550	85	1, 718, 700
Tobacco .... pounds	13, 860, 000	760	18, 237	11	1, 524, 600
Hay .... tons	588, 900	1. 23	478, 780	12 05	7, 096, 245
Total	....	....	5, 215, 891	....	64, 017, 615

Table showing the product of each principal crop, &c.—Continued.

Products.	Quantity produced in 1874.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
KANSAS.					
Indian corn .... bushels	16,065,000	10.5	1,530,000	$0 91	$14,619,150
Wheat .... do	9,455,000	13.7	690,146	84	7,942,200
Rye .... do	420,000	14	30,000	65	273,000
Oats .... do	7,847,000	24.5	320,286	53	4,158,910
Barley .... do	435,000	18	24,167	79	343,650
Buckwheat .... do	120,000	15	8,000	1 50	180,000
Potatoes .... do	1,116,000	24	46,500	1 12	1,249,920
Tobacco .... pounds	300,000	580	517	10	30,000
Hay .... tons	530,000	1	530,000	3 86	2,045,800
Total	....	....	3,179,616	....	30,842,630
NEBRASKA.					
Indian corn .... bushels	3,500,000	10	350,000	73	2,555,000
Wheat .... do	3,619,000	11.6	311,983	60	2,171,400
Rye .... do	32,000	17.5	1,828	74	23,680
Oats .... do	1,944,000	23.1	84,156	50	972,000
Barley .... do	355,000	24.4	14,549	86	305,300
Buckwheat .... do	....	....	....	....	....
Potatoes .... do	275,000	33	8,333	1 03	283,250
Tobacco .... pounds	....	....	....	....	....
Hay .... tons	180,500	1.20	150,417	4 74	855,570
Total	....	....	921,266	....	7,166,200
CALIFORNIA.					
Indian corn .... bushels	1,617,000	36.2	44,668	98	1,584,660
Wheat .... do	28,380,000	13.2	2,150,000	99	28,096,200
Rye .... do	46,000	18	2,555	1 03	47,380
Oats .... do	2,356,000	35.8	65,810	69	1,625,640
Barley .... do	11,031,000	20	551,550	78	8,604,180
Buckwheat .... do	20,000	23	869	1 20	24,000
Potatoes .... do	2,688,000	120	22,400	1 11	2,983,680
Tobacco .... pounds	....	....	....	....	....
Hay .... tons	641,700	1.40	458,357	15 09	9,683,253
Total	....	....	3,296,209	....	52,648,993
OREGON.					
Indian corn .... bushels	94,000	30.5	3,082	94	88,360
Wheat .... do	4,875,000	19.5	250,000	68	3,315,000
Rye .... do	4,300	25	172	61	2,623
Oats .... do	2,391,000	36.7	65,150	42	1,004,220
Barley .... do	371,000	27.5	13,491	55	204,050
Buckwheat .... do	900	26	34	1 05	945
Potatoes .... do	751,000	123	6,106	51	383,010
Tobacco .... pounds	....	....	....	....	....
Hay .... tons	103,600	1.40	74,000	11 50	1,191,400
Total	....	....	412,035	....	6,189,608
NEVADA.					
Indian corn .... bushels	12,500	29	431	1 50	18,750
Wheat .... do	360,000	19	18,947	1 75	630,000
Rye .... do	....	....	....	....	....
Oats .... do	80,000	35	2,286	1 00	80,000
Barley .... do	450,000	25	18,000	1 25	562,500
Buckwheat .... do	....	....	....	....	....
Potatoes .... do	180,000	105	1,714	2 00	360,000
Tobacco .... pounds	....	....	....	....	....
Hay .... tons	55,000	1.35	40,741	20 00	1,100,000
Total	....	....	82,119	....	2,751,250
THE TERRITORIES.					
Indian corn .... bushels	1,260,000	28	45,000	1 00	1,260,000
Wheat .... do	2,355,000	19	123,947	1 02	2,402,100
Rye .... do	....	....	....	....	....
Oats .... do	1,500,000	30	50,000	75	1,125,000
Barley .... do	420,000	28	15,000	97	407,400
Buckwheat .... do	....	....	....	....	....
Potatoes .... do	860,000	110	7,818	1 10	946,000
Tobacco .... pounds	....	....	....	....	....
Hay .... tons	150,000	1.35	111,111	13 50	2,025,000
Total	....	....	352,876	....	8,165,500

Summary for each State, showing the product, the area, and the value of each crop for 1874.

States.	INDIAN CORN.			WHEAT.			RYE.		
	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.
Maine	809,000	32,886	$914,170	291,000	19,400	$448,140	32,000	1,808	$38,080
New Hampshire	1,239,000	34,038	1,387,680	174,000	10,875	269,700	41,000	1,863	49,200
Vermont	1,660,000	45,983	1,826,000	418,000	24,588	597,740	61,000	3,697	64,660
Massachusetts	1,431,000	44,719	1,574,100	35,000	2,414	50,750	258,000	18,695	286,380
Rhode Island	279,000	11,461	329,220	....	....	....	20,800	1,223	24,128
Connecticut	1,687,000	56,233	1,973,790	39,700	2,205	57,565	339,000	23,379	410,190
New York	16,807,000	560,233	15,630,510	9,161,000	587,243	11,542,860	1,834,000	130,071	1,687,280
New Jersey	9,397,000	268,486	7,705,540	1,986,000	128,129	2,581,800	480,000	36,641	441,600
Pennsylvania	35,821,000	1,078,946	27,223,960	16,636,000	1,124,054	20,129,560	3,250,000	227,273	2,925,000
Delaware	2,841,000	157,833	1,988,700	588,000	53,454	770,280	10,800	964	8,100
Maryland	10,032,000	489,366	7,323,360	5,209,000	486,822	6,354,980	271,000	23,565	235,770
Virginia	19,082,000	954,100	12,212,480	5,672,000	727,179	6,636,240	460,000	43,809	363,400
North Carolina	22,186,000	1,352,805	15,973,920	2,878,000	359,750	3,971,640	334,000	39,294	307,280
South Carolina	10,169,000	924,454	10,169,000	579,000	91,905	1,071,150	42,000	6,000	65,100
Georgia	24,494,000	2,206,667	22,534,480	2,611,000	357,671	3,994,830	112,000	16,000	169,120
Florida	2,112,000	199,245	2,090,880	....	....	....	....	....	....
Alabama	20,228,000	1,644,553	18,812,040	1,087,000	120,778	1,587,020	21,000	2,308	31,500
Mississippi	18,357,000	1,330,217	18,540,570	275,000	29,891	481,250	14,000	1,489	22,540
Louisiana	7,836,000	505,548	7,836,000	....	....	....	....	....	....
Texas	28,016,000	1,474,526	21,012,000	1,474,000	117,920	1,989,900	40,000	3,077	44,400
Arkansas	9,724,000	771,746	9,237,800	1,177,000	112,095	1,789,040	39,000	3,071	53,430
Tennessee	31,953,000	1,901,964	21,728,040	11,121,000	1,235,667	11,788,260	238,000	22,667	249,900
West Virginia	8,803,000	332,189	5,369,830	3,268,000	281,724	3,268,000	268,000	20,458	230,480
Kentucky	48,514,000	1,940,560	26,682,700	8,525,000	804,245	8,525,000	1,095,000	99,545	1,007,400
Ohio	88,422,000	2,456,167	51,284,760	25,993,000	1,732,867	27,032,720	392,000	31,111	317,520
Michigan	12,689,000	469,963	8,247,850	17,341,000	1,221,197	18,728,280	228,000	15,616	184,680
Indiana	74,624,000	2,763,852	38,058,240	23,331,000	1,912,377	21,931,140	397,000	27,379	305,690
Illinois	133,579,000	7,421,055	74,804,240	30,122,000	2,619,304	25,904,920	2,036,000	132,208	1,445,560
Wisconsin	15,492,000	549,362	9,759,960	18,436,000	1,603,130	15,301,880	1,091,000	82,030	850,980
Minnesota	7,548,000	243,484	3,849,480	21,338,000	1,592,388	14,936,600	145,000	7,838	85,550
Iowa	115,720,000	3,963,014	49,759,600	33,908,000	2,923,103	22,040,200	485,000	28,198	305,550
Missouri	46,049,000	2,878,062	34,076,260	15,385,000	1,139,629	12,769,550	454,000	30,884	313,260
Kansas	16,065,000	1,530,000	14,619,150	9,455,000	690,146	7,942,200	420,000	30,000	273,000
Nebraska	3,500,000	350,000	2,555,000	3,619,000	311,983	2,171,400	32,000	1,828	23,680
California	1,617,000	44,668	1,584,660	28,380,000	2,150,000	28,096,200	46,000	2,555	47,380
Oregon	94,000	3,082	88,360	4,875,000	250,000	3,315,000	4,300	172	2,623
Nevada	12,500	431	18,750	360,000	18,947	690,000	....	....	....
The Territories	1,260,000	45,000	1,260,000	2,355,000	123,947	2,402,100	....	....	....
Total	850,148,500	41,036,918	550,043,080	309,102,700	24,967,027	291,107,895	14,990,900	1,116,716	12,870,411

Summary for each State, showing the product, the area, and the value of each crop for 1874—Continued.

States.	Oats.			Barley.			Buckwheat.		
	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.
Maine	1,657,000	59,178	$1,110,190	438,000	21,900	$407,340	396,000	18,000	$304,920
New Hampshire	1,033,000	27,473	671,450	84,000	3,231	85,680	86,000	4,300	53,320
Vermont	4,151,000	112,189	2,366,070	112,000	4,000	113,120	372,000	16,533	271,560
Massachusetts	751,000	20,746	503,170	112,000	5,022	114,240	56,000	3,733	40,320
Rhode Island	142,000	4,733	103,660	24,000	923	26,880	......	......	......
Connecticut	1,013,000	32,159	729,360	23,400	1,063	27,612	124,000	7,750	112,840
New York	30,302,000	923,841	17,272,140	6,463,000	297,834	7,561,710	2,917,000	162,055	2,333,600
New Jersey	3,284,000	145,955	1,970,400	7,300	405	8,760	267,000	18,936	234,960
Pennsylvania	25,607,000	1,040,935	15,108,130	437,000	19,000	437,000	2,062,000	101,078	1,752,700
Delaware	397,000	18,905	206,440	1,700	101	1,700	1,200	53	960
Maryland	2,434,000	147,515	1,338,700	10,000	555	10,000	61,000	3,351	50,020
Virginia	4,587,000	398,869	2,476,980	6,300	525	5,985	40,000	2,963	28,000
North Carolina	3,083,000	238,992	2,034,780	3,200	270	2,560	19,500	1,345	11,310
South Carolina	715,000	62,174	650,650	6,300	420	5,166	......	......	......
Georgia	4,560,000	447,059	4,012,800	8,800	607	16,456	......	......	......
Florida	117,000	9,750	118,170	......	......	......	......	......	......
Alabama	626,000	53,965	569,660	7,500	652	7,500	......	......	......
Mississippi	639,000	44,069	651,780	......	......	......	......	......	......
Louisiana	28,000	2,276	30,240	......	......	......	......	......	......
Texas	1,118,000	41,103	939,120	63,000	2,065	54,180	......	......	......
Arkansas	573,000	38,200	429,750	......	......	......	......	......	......
Tennessee	3,816,000	272,571	2,175,120	84,000	4,117	94,080	76,000	6,333	56,240
West Virginia	1,684,000	102,683	892,520	50,000	2,778	50,000	62,000	3,503	50,220
Kentucky	4,292,000	298,055	2,360,600	257,000	9,518	287,840	3,000	200	2,520
Ohio	17,317,000	844,732	8,485,330	1,182,000	51,391	1,300,200	192,000	15,360	172,800
Michigan	8,434,000	312,370	4,217,000	463,000	26,457	532,450	298,000	19,226	229,460
Indiana	11,628,000	612,000	5,116,320	539,000	26,165	592,900	155,000	11,071	86,800
Illinois	31,824,000	1,818,514	14,320,800	2,052,000	119,302	1,990,440	136,000	10,461	119,680
Wisconsin	14,335,000	547,137	6,594,100	1,151,000	57,550	1,151,000	375,000	24,193	232,500
Minnesota	11,135,000	371,167	4,899,400	954,000	39,421	791,820	45,000	3,214	32,850
Iowa	19,650,000	655,000	7,467,000	4,725,000	236,250	3,638,250	107,000	8,106	78,110
Missouri	13,319,000	605,409	6,259,930	226,000	12,417	241,820	25,000	1,923	17,250
Kansas	7,847,000	320,286	4,158,910	435,000	24,167	343,650	120,000	8,000	180,000
Nebraska	1,944,000	84,156	972,000	355,000	14,549	305,300	......	......	......
California	2,356,000	65,810	1,625,640	11,031,000	551,550	8,604,180	20,000	869	24,000
Oregon	2,391,000	65,150	1,004,220	371,000	13,491	201,050	900	34	945
Nevada	80,000	2,286	80,000	450,000	18,000	562,500	......	......	......
The Territories	1,500,000	50,000	1,125,000	420,000	15,000	407,400	......	......	......
Total	240,369,000	10,897,412	125,047,530	32,552,500	1,580,626	29,983,769	8,016,600	452,590	6,477,885

Summary for each State, showing the product, the area, and the value of each crop for 1874—Continued.

States.	POTATOES.			TOBACCO.			HAY.		
	Bushels.	Acres.	Value.	Pounds.	Acres.	Value.	Tons.	Acres.	Value.
Maine	4, 600, 000	37, 398	$2, 484, 000	....	....	....	1, 131, 900	1, 286, 250	$14, 861, 847
New Hampshire	3, 400, 000	28, 333	2, 006, 000	180, 000	141	$36, 000	767, 200	685, 000	10, 073, 336
Vermont	4, 782, 000	32, 979	2, 056, 260	105, 000	99	21, 000	973, 500	853, 947	11, 487, 300
Massachusetts	2, 449, 000	22, 263	1, 689, 810	4, 920, 000	3, 393	1, 377, 600	523, 700	447, 607	11, 207, 180
Rhode Island	550, 000	5, 789	451, 000	....	....	....	95, 600	79, 667	2, 357, 496
Connecticut	2, 727, 000	25, 971	1, 963, 440	9, 030, 000	7, 224	2, 889, 600	661, 200	508, 615	12, 728, 100
New York	25, 423, 000	242, 124	14, 491, 110	1, 593, 000	2, 451	207, 090	5, 291, 800	4, 070, 615	69, 322, 580
New Jersey	2, 919, 000	41, 700	2, 276, 820	....	....	....	520, 300	385, 407	8, 439, 266
Pennsylvania	9, 223, 000	109, 797	7, 286, 170	10, 500, 000	9, 130	1, 575, 000	2, 421, 900	2, 087, 845	41, 293, 395
Delaware	163, 000	2, 328	117, 360	....	....	....	34, 100	31, 000	682, 000
Maryland	881, 000	17, 620	687, 180	16, 500, 000	27, 049	1, 567, 500	164, 300	131, 440	2, 896, 609
Virginia	1, 068, 000	15, 706	683, 520	35, 000, 000	63, 636	4, 200, 000	166, 400	158, 476	2, 808, 832
North Carolina	702, 000	9, 360	484, 380	8, 500, 000	25, 757	1, 360, 000	104, 800	83, 840	1, 554, 184
South Carolina	78, 000	1, 114	75, 660	45, 000	100	6, 750	22, 400	22, 400	533, 792
Georgia	159, 000	2, 271	173, 310	291, 000	502	37, 830	17, 500	15, 909	390, 775
Florida	....	....	....	216, 000	327	47, 520	....	....	....
Alabama	136, 000	2, 266	178, 160	166, 000	302	33, 200	15, 300	14, 571	267, 750
Mississippi	127, 000	2, 268	148, 590	80, 000	133	16, 800	13, 000	10, 400	274, 170
Louisiana	46, 000	767	44, 160	....	....	....	12, 900	10, 750	258, 000
Texas	233, 000	3, 328	347, 170	141, 000	188	31, 725	62, 000	44, 286	677, 040
Arkansas	224, 000	5, 209	244, 160	708, 000	1, 348	106, 200	10, 800	9, 643	152, 496
Tennessee	605, 000	12, 100	586, 850	5, 780, 000	9, 633	578, 000	114, 300	103, 909	2, 180, 844
West Virginia	782, 000	10, 289	563, 040	1, 690, 000	2, 224	236, 600	167, 800	190, 682	2, 746, 886
Kentucky	955, 000	20, 761	945, 450	34, 500, 000	53, 906	4, 278, 000	253, 400	269, 574	4, 616, 948
Ohio	5, 500, 000	77, 465	4, 730, 000	13, 000, 000	18, 055	1, 170, 000	1, 655, 600	1, 839, 555	29, 502, 792
Michigan	7, 601, 006	87, 368	4, 788, 630	....	....	....	916, 600	916, 600	14, 298, 960
Indiana	2, 091, 000	34, 850	1, 693, 710	12, 000, 000	26, 086	1, 128, 000	803, 900	711, 416	11, 190, 288
Illinois	7, 438, 000	135, 236	6, 173, 540	7, 000, 000	8, 974	735, 000	2, 232, 500	1, 860, 417	23, 418, 925
Wisconsin	5, 956, 000	68, 460	2, 918, 440	2, 250, 000	2, 250	168, 750	1, 164, 500	1, 058, 636	11, 726, 515
Minnesota	2, 465, 000	35, 214	1, 207, 850	....	....	....	817, 800	605, 778	4, 170, 780
Iowa	4, 806, 000	76, 286	2, 403, 000	....	....	....	1, 747, 200	1, 432, 131	11, 304, 384
Missouri	2, 022, 000	50, 550	1, 718, 700	13, 860, 000	18, 237	1, 524, 600	588, 900	478, 780	7, 096, 245
Kansas	1, 116, 000	46, 500	1, 249, 920	300, 000	517	30, 000	530, 000	530, 000	2, 045, 600
Nebraska	275, 000	8, 333	283, 250	....	....	....	180, 500	150, 417	855, 570
California	2, 688, 000	22, 400	2, 983, 680	....	....	....	641, 700	458, 357	9, 683, 253
Oregon	751, 000	6, 106	383, 010	....	....	....	103, 600	74, 000	1, 191, 400
Nevada	180, 000	1, 714	360, 000	....	....	....	55, 000	40, 741	1, 100, 000
The Territories	860, 000	7, 818	946, 000	....	....	....	150, 000	111, 111	2, 025, 000
Total	105, 981, 000	1, 310, 041	71, 823, 330	178, 355, 000	281, 662	23, 362, 765	24, 133, 900	21, 769, 772	331, 420, 738

Table showing the average yield per acre and price per bushel, pound, or ton of farm-products for the year 1874.

States.	CORN.		WHEAT.		RYE.		OATS.		BARLEY.		BUCKWHEAT.		POTATOES.		TOBACCO.		HAY.	
	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Pounds.	Price per pound.	Tons.	Price per ton.
Maine	24.6	$1 13	15	$1 54	17.7	$1 19	28	$0 67	20	$0 93	22	$0 77	123	$0 54	......	......	88	$13 13
New Hampshire	36.4	1 12	16	1 55	22	1 20	37.6	65	26	1 02	20	62	120	59	1,275	$0 20	1.12	13 13
Vermont	36.1	1 10	17	1 43	16.5	1 06	37	57	28	1 01	22.5	73	145	43	1,060	20	1.14	11 80
Massachusetts	32	1 10	14.5	1 45	13.8	1 11	36.2	67	22.3	1 02	15	72	110	69	1,450	28	1.17	21 40
Rhode Island	24.3	1 18	......	......	17	1 16	30	73	26	1 12	......	......	95	82	......	......	1.20	24 66
Connecticut	30	1 17	18	1 45	14.5	1 21	31.5	72	22	1 18	16	91	105	72	1,250	32	1.30	19 25
New York	30	93	15.6	1 26	14.1	92	32.8	57	21.7	1 17	18	80	105	57	650	13	1.30	13 10
New Jersey	35	82	15.5	1 30	13.1	92	22.5	60	18	1 20	14.1	88	70	78	......	......	1.35	16 22
Pennsylvania	33.2	76	14.8	1 21	14.3	90	24.6	59	23	1 00	20.4	85	84	79	1,150	15	1.16	17 05
Delaware	18	70	11	1 31	11.2	75	21	52	16.8	1 00	22.5	80	70	72	......	......	1.10	20 00
Maryland	20.5	73	10.7	1 22	11.5	87	16.5	55	18	1 09	18.2	82	50	78	610	9.5	1.25	17 63
Virginia	20	64	7.8	1 17	10.5	79	11.5	54	12	95	13.5	70	68	64	550	12	1.05	16 88
North Carolina	16.4	72	8	1 38	8.5	92	12.9	66	16	80	14.5	58	75	69	330	16	1.25	14 83
South Carolina	11	1 00	6.3	1 85	7	1 55	11.5	91	15	82	......	......	70	97	450	15	1.00	23 83
Georgia	11.1	92	7.3	1 53	7	1 51	10.2	88	14.5	1 87	......	......	70	1 09	580	13	1.10	22 33
Florida	10.6	99	......	......	......	......	12	1 01	......	......	......	......	......	......	660	22	......	......
Alabama	12.3	93	9	1 46	9.1	1.50	11.6	91	11.5	1 00	......	......	60	1 31	550	20	1.05	17 50
Mississippi	13.8	1 01	9.2	1 75	9.4	1.61	14.5	1 02	......	......	......	......	56	1 17	600	21	1.25	21 09
Louisiana	15.5	1 00	......	......	......	......	12.3	1 08	......	......	......	......	60	96	......	......	1.20	20 00
Texas	19	75	12.5	1 35	13	1 11	27.2	84	30.5	86	......	......	70	1 49	750	22.5	1.40	10 92
Arkansas	12.6	95	10.5	1 52	12.7	1 37	15	75	......	......	......	......	43	1 09	525	15	1.12	14 12
Tennessee	16.8	68	9	1 06	10.5	1 05	14	57	20.4	1 12	12	74	50	97	606	10	1.10	19 08
West Virginia	26.5	61	11.6	1 00	13.1	86	16.4	53	18	1 00	17.7	81	76	72	760	14	88	16 37
Kentucky	25	55	10.6	1 00	11	92	14.4	55	27	1 12	15	84	46	99	640	12.4	94	18 22
Ohio	36	58	15	1 04	12.6	81	20.5	49	23	1 10	12.5	90	71	86	720	9	90	17 82
Michigan	27	65	14.2	1 08	14.6	81	27	50	17.5	1 15	15.5	77	87	63	......	......	1.00	15 60
Indiana	27	51	12.2	94	14.5	77	19	44	20.6	1 10	14	56	60	81	460	9.4	1.13	13 92
Illinois	18	56	11.5	86	15.4	71	17.5	45	17.2	97	13	88	55	83	780	10.5	1.20	10 49
Wisconsin	28.2	63	11.5	83	13.3	78	26.2	46	20	1 00	15.5	62	87	49	1,000	7.5	1.10	10 07
Minnesota	31	51	13.4	70	18.5	59	30	44	24.2	83	14	73	70	49	......	......	1.35	5 10
Iowa	29.2	43	11.6	65	17.2	63	30	38	20	77	13.2	73	63	50	......	......	1.22	6 47
Missouri	16	74	13.5	83	14.7	69	22	47	18.2	1 07	13	69	40	85	760	11	1.23	12 05
Kansas	10.5	91	13.7	84	14	65	24.5	53	18	79	15	1 50	24	1 12	580	10	1.00	3 86
Nebraska	10	73	11.6	60	17.5	74	23.1	50	24.4	86	......	......	33	1 03	......	......	1.20	4 74
California	36.2	98	13.2	99	18	1 03	35.8	69	20	78	23	1 20	1 20	1 11	......	......	1.40	15 09
Oregon	30.5	94	19.5	68	25	61	36.7	42	27.5	55	26	1 05	1 23	51	......	......	1.40	11 50
Nevada	29	1 50	19	1 75	......	......	35	1 00	25	1 25	......	......	1 05	2 00	......	......	1.35	20 00
The Territories	28	1 00	19	1 02	......	......	30	75	28	97	......	......	1 10	1 10	......	......	1.35	13 50

Table showing the average cash-value per acre of farm-products for the year 1874.

States.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buck-wheat.	Potatoes.	Tobacco.	Hay.
Maine	$27 80	$23 10	$21 06	$18 76	$18 60	$16 94	$66 42	....	$11 55
New Hampshire	40 77	24 80	26 40	24 44	26 52	12 40	.70 80	$255 00	14 70
Vermont	39 71	24 31	17 49	21 09	23 28	16 42	62 35	212 00	13 45
Massachusetts	35 20	21 02	15 32	24 25	22 74	10 80	75 90	406 00	25 04
Rhode Island	28 67	....	19 72	21 90	29 12	....	77 90	....	29 59
Connecticut	35 10	25 74	17 54	22 68	25 96	14 56	75 60	400 00	25 02
New York	27 90	19 65	12 97	18 69	25 39	14 40	59 85	84 50	17 03
New Jersey	28 70	20 15	12 05	13 50	21 60	12 41	54 60	....	21 90
Pennsylvania	25 23	17 91	12 87	14 51	23 00	17 34	66 36	172 50	19 78
Delaware	12 60	14 41	8 40	10 92	16 80	18 00	50 40	....	22 00
Maryland	14 96	13 05	10 00	9 07	18 00	14 92	39 00	57 95	22 01
Virginia	12 80	9 12	8 29	6 21	11 40	9 45	43 52	66 00	17 72
North Carolina	11 81	11 04	7 82	8 51	12 80	8 41	51 75	52 80	19 54
South Carolina	11 00	11 65	10 85	10 46	12 30	....	67 90	67 50	23 83
Georgia	10 21	11 17	10 57	8 97	27 11	....	76 30	75 40	24 56
Florida	10 49	....	....	12 12	....	....	....	145 20	....
Alabama	11 44	13 14	13 65	10 55	11 50	....	78 60	110 00	18 37
Mississippi	13 94	16 10	15 13	14 79	....	....	65 52	126 00	26 36
Louisiana	15 50	....	....	13 28	....	....	57 60	....	24 00
Texas	14 25	16 87	14 43	22 85	26 23	....	104 30	168 75	15 29
Arkansas	11 97	15 96	17 40	11 25	....	....	46 87	78 75	15 81
Tennessee	11 42	9 54	11 02	7 98	22 85	8 88	48 50	60 00	20 99
West Virginia	16 16	11 60	11 26	8 69	18 00	14 34	54 72	106 40	14 40
Kentucky	13 75	10 60	10 12	7 92	30 24	12 60	45 54	79 36	17 13
Ohio	20 88	15 60	10 20	10 04	25 30	11 25	61 06	64 80	16 04
Michigan	17 55	15 33	11 82	13 50	20 12	11 93	54 81	....	15 60
Indiana	13 77	11 47	11 16	8 36	22 66	7 84	48 60	43 24	15 73
Illinois	10 08	9 89	10 93	7 87	16 68	11 44	45 65	81 90	12 59
Wisconsin	17 76	9 54	10 37	12 05	20 00	9 61	42 63	75 00	11 08
Minnesota	15 81	10 36	10 91	13 20	20 08	10 22	34 30	....	6 88
Iowa	12 55	7 54	10 83	11 40	15 40	9 63	31 50	....	7 89
Missouri	11 84	11 20	10 14	10 34	19 47	8 97	34 00	83 60	14 62
Kansas	9 55	11 51	9 10	12 98	14 22	22 50	26 88	58 00	3 86
Nebraska	7 30	6 96	12 95	11 55	20 98	....	33 99	....	5 69
California	35 47	13 07	18 54	24 70	15 60	27 60	133 20	....	21 12
Oregon	28 67	13 26	15 25	15 41	15 12	27 30	62 73	....	16 10
Nevada	43 50	32 25	....	35 00	31 25	....	210 00	....	27 00
The Territories	28 06	19 38	....	22 50	27 16	....	121 00	....	18 22

Table showing the total average cash-value per acre of the principal crops of the farm for the year 1874.

States.	Average value per acre.	States.	Average value per acre.
Maine	$13 93	Texas	$14 88
New Hampshire	18 40	Arkansas	12 76
Vermont	17 19	Tennessee	11 05
Massachusetts	29 62	West Virginia	14 16
Rhode Island	31 71	Kentucky	13 93
Connecticut	31 43	Ohio	17 54
New York	20 07	Michigan	16 69
New Jersey	23 07	Indiana	13 08
Pennsylvania	20 30	Illinois	10 54
Delaware	14 27	Wisconsin	12 20
Maryland	15 42	Minnesota	10 34
Virginia	12 43	Iowa	10 40
North Carolina	12 17	Missouri	12 27
South Carolina	11 34	Kansas	9 70
Georgia	10 28	Nebraska	7 78
Florida	10 78	California	15 97
Alabama	11 68	Oregon	15 02
Mississippi	14 19	Nevada	33 50
Louisiana	15 73	The Territories	23 14

A general summary showing the estimated quantities, number of acres, and aggregate value of the principal crops of the farm in 1874.

Products.	Number of bushels, &c.	Number of acres.	Value.
Indian corn ....bushels..	850, 148, 500	41, 036, 918	$550, 043, 080
Wheat ....do....	309, 102, 700	24, 967, 027	291, 107, 895
Rye ....do....	14, 990, 900	1, 116, 716	12, 870, 411
Oats ....do....	240, 369, 000	10, 897, 412	125, 047, 530
Barley ....do....	32, 552, 500	1, 580, 626	29, 983, 769
Buckwheat ....do....	8, 016, 600	452, 590	6, 477, 885
Potatoes ....do....	105, 981, 000	1, 310, 041	71, 823, 330
Total........	1, 561, 161, 200	81, 361, 330	1, 087, 353, 900
Tobacco........pounds..	178, 355, 000	281, 662	23, 362, 765
Hay........tons..	24, 133, 900	21, 769, 772	331, 420, 738
Cotton ....bales..	3, 800, 000	....	256, 215, 000
Total........	....	....	....

Table showing the average yield and cash-value per acre, and price per bushel, pound, or ton of farm-products for the year 1874.

Products.	Average yield per acre.	Average price per bushel.	Average value per acre.	Products.	Average yield per acre.	Average price per bushel, ton, or pound.	Average value per acre.
Indian corn ......bush.	20. 7+	$0 64. 7−	$13 40	Buckwheat .....bush.	17. 7 +	$0 80. 8+	$14 31
Wheat ....do..	12. 3+	94. 1+	11 66	Potatoes........do..	80. 9 −	67. 7+	54 82
Rye ....do..	13. 4+	85. 8+	11 52	Tobacco ....lbs.	633. 2 +	13. 1−	82 94
Oats........do..	22. 0+	52. 0+	11 47	Hay ....tons.	1. 11−	13 73. 2+	15 22
Barley........do..	20. 6−	92. 1+	18 96	Cotton ....lbs.	....	14. 5	....

CONDITION OF FARM-ANIMALS.

The United States include a territory so vast and climates so various that each winter brings to farm-stock local vicissitudes, ranging from one extreme to its opposite. While the winter of 1872-'73 was quite uniformly cold and dry east of the Rocky Mountains, an unusual mildness pervaded the Pacific slope. That of 1873-'74 was one of extraordinary length and severity west of the great mountains, causing much mortality and great leanness of kine in all that region; while in the more eastern portions of the country a mild winter was observed, especially exempt from injurious northers in Texas, so that animals there, unsheltered and unfed, not only escaped suffering, but improved in condition. In the Ohio and Mississippi Valleys, though the temperature was moderate, the season was disagreeably wet and changeable, and the feeding season was a long one, as winter set in with considerable severity in November. On the whole, the condition of stock in winter was one of average health and comfort, and higher than average if we except the losses of the Pacific coast. The average loss in mortality and depreciation of flesh and vitality, whether it be estimated at $50,000,000 or $75,000,000, is a fact that should astonish the political economist, and excite the indignation of societies for the prevention of cruelty to animals. Should the loss be but $30,000,000 in a favorable season, it would be a fact for especial congratulation, and stock-growers might felicitate themselves upon their unusual provision for and care of their domestic animals. It is fair to say, however, that by far the greater portion of this loss occurs in the cotton States, in the great Texas and Missouri River plains, and beyond the Sierras, where great herds and flocks are left to themselves and to nature. Fortunately, as the country is filling with population and improving with settlement, the nomadic stock-grower is beginning to disappear, following closely upon the exit of the Indian and the buffalo, and with him will disappear the Texan steer and the mustang pony, and the wild and thriftless status of unfed and unsheltered herds and flocks.

Our correspondents reported losses in many counties in California ranging from 10 per cent. up to 33, amounting in some cases to five thousand cattle in a county, and in extreme cases to about ten thousand. In Washington Territory the winter was more severe than any previous season since 1861-'62, when 50 per cent. of the cattle in a district east of the Cascade Mountains perished. The weather was very cold in Idaho, longer than usual, and as little food and no shelter were provided, "more severe on cattle than any winter since the Territory was settled." In Colorado and Wyoming the winter was mild, and but little suffering or loss resulted. In parts of Kansas provision for the sustenance and comfort of stock was made with entire exemption from loss; in other districts the usual negligence prevailed. Early winter and short feed are reported in some places; and there, also, "many skeletons are scattered on the prairies." Much loss resulted in localities through neglect to store up hay, though grass "was abundant and might have been had for the cutting." The Utah Basin experienced greater severity than the region east of the Sierra Madre, and stock wintered worse than usual. In New Mexico and Southern Arizona a favorable season for stock has been generally reported. A healthy and thrifty condition of stock was the uniform report of New England and the Middle States; and in the Southern Atlantic States there was much less suffering and mortality than usual, and a larger number

of instances of special care and unaccustomed provision of feeding material. In the States bordering upon the Ohio the principal drawback was a wet and changeable season.

The early part of the present winter (of 1874–'75) has been favorable to fine condition of cattle, on account of general mild temperature and exemption from severe storms. Feeding did not become necessary as early as usual, and the prospect is favorable for an abundant supply of feeding material.

The influences affecting the condition of cattle apply measurably to sheep, and similar reports are made of the wintering of our flocks. East of the Rocky Mountains and north of Texas the value of fleeces has secured comparative protection to sheep, and in Texas flocks have, fortunately, done very well without it. Those remaining east of the Mississippi are generally in the hands of owners who know the importance of care. Some large flocks sent across the Missouri have suffered from neglect and exposure; in Bourbon, Kansas, one of 400 lost 35 per cent., while flocks properly cared for wintered well. On the Pacific coast they fared little better than the cattle.

DISEASES OF FARM-ANIMALS.—The sanitary condition of farm-stock is more favorable than usual, mainly because the vicissitudes of the season have been less inimical to healthfulness. Gradually the influence of better treatment on health is dawning upon the minds of the more improvident owners, though such education is slow and dearly bought. In several instances where animals have been turned out too early to shift for themselves, diseases have been reported in unusual prevalence.

Horses.—Leaving out of view the relapses from and effects of the epizootic-influenza, the record of horse-diseases in 1874 would be quite unimportant. Diseases reported are of a milder type than usual. The fatalities noted are mainly the results of neglect and improper treatment, either in health or after symptoms of disease have been developed. Yet in this respect there is a growing improvement. Men are discovering that the dictates of mercy coincide with those of an enlightened self-interest. Public sentiment is also awakening to a closer scrutiny of the treatment of the useful animals, thus largely counteracting the temptations to thoughtless cruelty, which have too often disgraced our civilization. There can be little doubt that a proper treatment of horses would diminish their liability to disease, and consequently depress the rate of mortality, thus effecting a great saving to the industrial interests of the country.

The results of the epizootic influenza of two years ago had not entirely disappeared last season. Permanent injury resulted in a considerable proportion of the numbers recovering. It will be remembered that there was a very small percentage of immediately fatal cases. In some instances injurious results were for a long time visible; in others, apparent relapses occurred; in ill-treated and overworked horses, diseases of the lungs, spine, and kidneys were perhaps more frequent than others, but the usual variety of equine diseases were reported in different sections of the country.

Cattle.—The Texas cattle-fever was more or less destructive in the States from Indiana to Kansas. In Fountain, Indiana, twenty deaths followed the contact of natives with Texans. The southern part of Sangamon, Illinois, was visited during the summer, and hundreds died, occasioning great alarm in the community. A large percentage of cases was among "Missouri cattle," which had passed through the Saint Louis stock-yards. Cattle known to be Texas cattle were not affected themselves. Several hundred deaths are reported in Macoupin,

Illinois. In Missouri several counties report considerable fatality from the presence of Texas cattle. Nodaway lost two hundred; Caldwell, over one hundred in a few herds in the town of Kidder. Jasper, Pettis, Stone, Saint Clair, and Vernon report numerous cases, as also Howard County, Kansas. Abortion has been quite common, especially in New York and New Jersey. Deaths from black-leg were reported from all points of the country. Pleuro-pneumonia was spread through the country contiguous to New York by the sale of distillery-fed cattle of that city and Brooklyn.

Unnamed diseases were reported in different parts of the country. In Caledonia, Vermont, calves about four months old became stupid, refusing to eat, and died in convulsions in from twelve to sixteen hours. Many farmers lost half their calves. In Washington, Kansas, an affection of the lungs, accompanied by weak eyes discharging matter, was somewhat troublesome. In Redwood, Minnesota, many young cattle died of an unknown disease; they were usually taken with stiffness, loss of appetite; would lie down, never to rise again; the hind parts became paralyzed; death supervened in from twenty-four to forty-eight hours, sometimes accompanied with severe pains, and sometimes not; the blood then congested in dark blotches; the animals affected were mostly in good condition. In Nemaha, Kansas, in herds kept during the summer in close range and fed on prairie-hay, many cattle apparently in good condition previously were found dead without any apparent disease. In Butler, Kansas, many Texas cows, heavy with calf, died suddenly of an unknown disease. In Riley, Kansas, close herding, cruelty, and starvation have brought in disease for which no popular name has been found. In Wasco, Oregon, during twenty years, there was a foot-disease, resulting in the entire loss of the hoof. It was not very prevalent, however, and disappeared with the return of spring. In Burke, North Carolina, about five per cent. died of a fever that has infested the county for ten years. In Wilkes, Georgia, a few cases of fever were successfully treated with sulphur and sulphate of iron. In Clinton, Illinois, one hundred and twenty-five cattle died with high fever and acute pain. The maw, on dissection, appeared to be hard, dry, and about two-thirds full of mud. The animals had fed upon the dry prairie, and had drunk of the muddy waters of its stagnant pools. The Territories present a remarkable exemption from disease; not a county reports anything like a prevalent type.

In Assumption, Louisiana, cattle became weak and emaciated, lumps about the size of an egg forming along the back. These, on being opened, were found to be filled with worms precisely of the form and size of bot-worms in horses. In Putnam, Illinois, stock were affected with eye-diseases; no fatalities. In Washington, Kansas, cattle died so suddenly as to give suspicion of poisoning. A post-mortem examination showed inflammation and gangrene of the stomach, and worms filling the intestinal canal. Some attributed this result to drinking stagnant water in the holes of the dry prairie. A case of gross abuse and cruelty is reported in Ralls, Missouri. A large herd, principally the refuse of the Saint Louis market, were grazed on the prairie, and herded at night in small inclosures. At midsummer, when water was scarce and the animals had no supply except from filthy pools, a disease broke out, and one hundred died. In Miami, Kansas, small feeders met with considerable losses through neglect, exposure, and poor feeding. In Del Norte, California, some calves died, it is supposed, of leeches in the liver.

Sheep.—In New England, New Jersey, Delaware, Maryland, North Carolina, South Carolina, Florida, Alabama, Mississippi, West Virginia,

Michigan, Wisconsin, Minnesota, and Nebraska sheep-diseases have been too inconsiderable to deserve mention. In the other States the staple complaint is of liver-rot, foot-rot, scab, and grub in the head. In various portions of the Middle, Southern, and Western States, the chronic grievance of "worthless curs" is aggravated by increased ravages. In some counties sheep-husbandry is entirely prostrated. Our correspondent in Seneca, New York, puts the case strongly and pathetically in describing the loss of choice Merinos by one of his assistants. He says: "None but those who have spent long years and money without stint, in bringing to perfection a thorough-bred flock, can appreciate the loss and discouragement."

Swine.—The most unhealthy (if not most unwholesome) of farm-animals has not been exempt from "cholera" and other ailments the past year. The mortality among swine is annually the cause of loss of a considerable portion of the profits of their production, which would otherwise be large. The losses were heaviest in the Western and Southern States, as usual, and especially where large numbers are kept together, and among those fed upon distillery slops. As usual, these are localities that have suffered the loss of twenty to thirty per cent. of the entire numbers.

Table showing the estimated total number and total value of each kind of live-stock and the average price in January, 1875.

States.	HORSES.			MULES.			MILCH-COWS.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	78,700	$94 61	$7,445,807	....	....	....	162,700	$39 50	$6,426,650
New Hampshire	47,000	92 38	4,341,860	....	....	....	35,400	39 57	3,774,978
Vermont	72,400	91 43	6,619,532	....	....	....	201,500	36 40	7,334,600
Massachusetts	105,800	115 08	12,175,464	....	....	....	139,000	46 50	6,463,500
Rhode Island	14,700	108 60	1,596,420	....	....	....	20,400	44 25	902,700
Connecticut	50,600	102 36	5,179,416	....	....	....	113,200	42 87	4,852,824
New York	665,800	89 82	59,802,156	18,500	$114 96	$2,126,760	1,467,000	37 50	55,012,500
New Jersey	115,700	119 09	13,778,713	15,000	134 97	2,024,550	147,900	47 50	7,025,250
Pennsylvania	573,700	93 76	53,790,112	25,600	117 89	3,017,984	828,800	35 42	29,356,096
Delaware	20,000	81 98	1,639,600	4,000	113 37	453,480	22,400	32 00	716,800
Maryland	104,500	88 85	9,284,825	10,800	118 18	1,276,344	99,800	29 19	2,913,162
Virginia	191,100	72 22	13,801,242	29,800	97 21	2,896,858	229,300	22 94	5,260,142
North Carolina	133,100	78 45	10,441,695	49,300	95 43	4,704,699	197,100	16 00	3,153,600
South Carolina	57,500	96 93	5,573,475	46,100	113 57	5,235,577	159,300	21 50	3,424,950
Georgia	117,200	90 86	10,648,792	91,700	108 66	9,964,122	257,400	18 85	4,851,990
Florida	16,600	95 79	1,590,114	9,800	117 64	1,152,872	66,200	13 67	904,954
Alabama	104,400	69 85	7,292,340	102,500	81 18	8,320,950	169,900	17 86	3,034,414
Mississippi	88,300	79 83	7,048,989	96,100	91 61	8,803,721	180,100	20 86	3,756,886
Louisiana	74,900	82 60	6,186,740	79,900	101 22	8,087,478	87,000	20 23	1,760,010
Texas	720,000	32 58	23,457,600	101,600	47 29	4,804,664	526,500	13 33	7,018,245
Arkansas	154,300	59 39	9,163,877	81,000	72 18	5,846,560	151,800	15 88	2,410,584
Tennessee	318,000	65 24	20,746,320	107,300	73 57	7,894,061	242,700	18 03	4,375,881
West Virginia	106,600	63 15	6,731,790	2,400	72 86	174,864	124,300	27 25	3,387,175
Kentucky	350,700	59 69	20,933,283	81,000	61 92	5,015,520	222,500	26 49	5,894,025
Ohio	753,300	74 27	55,947,591	22,900	73 75	1,688,875	778,500	30 42	23,681,970
Michigan	291,100	80 30	23,375,330	3,700	87 04	322,048	357,600	32 80	11,729,280
Indiana	662,400	64 11	42,466,464	59,000	64 65	3,814,350	448,400	26 34	11,810,856
Illinois	1,070,300	62 62	67,022,186	110,000	72 82	8,010,200	725,100	28 59	20,730,609
Wisconsin	348,700	77 06	26,870,822	5,100	90 44	461,244	464,800	26 37	12,256,776
Minnesota	165,800	72 80	12,070,240	3,200	83 11	265,952	222,400	25 20	5,604,480
Iowa	647,000	64 44	41,692,680	36,000	74 87	2,695,320	592,200	26 50	15,693,300
Missouri	570,100	43 10	24,571,310	125,000	58 27	7,283,750	421,400	19 50	8,217,300
Kansas	220,700	44 21	9,757,147	19,600	59 84	1,172,864	235,700	20 65	4,867,205
Nebraska	61,800	62 17	3,842,106	4,300	97 59	419,637	53,800	28 29	1,522,002
California	230,100	41 61	9,574,461	23,200	66 49	1,542,568	340,000	32 19	10,944,600
Oregon	85,500	41 48	3,546,540	3,700	47 83	176,971	76,400	21 65	1,654,060
Nevada	10,200	54 50	555,900	1,050	73 00	76,650	9,300	33 50	311,550
The Territories	105,600	55 00	5,808,000	24,600	72 00	1,771,200	269,000	29 94	8,053,860
Total	9,504,200	....	646,370,939	1,393,750	....	111,502,713	10,906,800	....	311,089,824
Grand average of prices	....	68 01	....	....	80 00	....	....	28 52	....

Table showing the estimated total number and total value of each kind of live-stock, &c.—Continued.

States.	Oxen and other cattle.			Sheep.			Hogs.		
	Number.	Average price.	Value.	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	201, 900	$38 08	$7, 688, 352	491, 500	$4 11	$2, 020, 065	60, 100	$12 92	$776, 492
New Hampshire	116, 900	39 22	4, 584, 818	242, 400	3 64	882, 336	37, 000	14 15	523, 550
Vermont	130, 500	30 82	4, 022, 010	516, 400	3 93	2, 029, 452	52, 400	12 50	655, 000
Massachusetts	121, 300	38 80	4, 706, 440	76, 300	3 48	265, 524	75, 600	15 19	1, 146, 364
Rhode Island	16, 000	50 04	800, 640	25, 300	4 50	113, 850	16, 500	15 75	259, 875
Connecticut	115, 300	45 16	5, 206, 948	88, 100	4 00	352, 400	60, 400	13 44	811, 776
New York	669, 900	33 98	22, 763, 202	1, 996, 400	3 77	7, 526, 428	586, 300	9 85	5, 775, 055
New Jersey	83, 900	36 39	3, 053, 121	127, 100	5 25	667, 275	164, 600	12 43	2, 045, 978
Pennsylvania	722, 600	28 31	20, 456, 806	1, 674, 000	3 62	6, 059, 880	930, 900	9 80	9, 122, 820
Delaware	31, 700	21 25	673, 625	23, 200	3 37	78, 184	48, 200	5 87	282, 934
Maryland	121, 800	22 50	2, 740, 500	138, 500	4 08	565, 080	248, 500	5 93	1, 473, 605
Virginia	397, 500	15 52	6, 169, 200	367, 500	2 98	1, 095, 150	662, 700	4 10	2, 717, 070
North Carolina	310, 100	8 80	2, 728, 880	275, 700	1 58	435, 606	806, 800	3 31	2, 670, 508
South Carolina	186, 700	12 17	2, 272, 139	147, 200	2 15	316, 480	303, 200	4 46	1, 352, 272
Georgia	393, 100	9 58	3, 765, 898	375, 000	1 62	607, 500	1, 511, 900	3 70	5, 594, 030
Florida	352, 900	8 50	2, 999, 650	31, 500	1 95	61, 425	190, 700	2 88	549, 216
Alabama	330, 700	10 46	3, 459, 122	182, 300	1 99	362, 777	910, 800	3 09	2, 814, 372
Mississippi	316, 600	11 68	3, 697, 888	147, 400	2 00	294, 800	769, 900	3 75	2, 887, 125
Louisiana	168, 600	10 03	1, 691, 058	62, 600	1 88	117, 688	210, 000	3 58	751, 800
Texas	2, 367, 400	7 50	17, 755, 500	1, 445, 700	1 92	2, 775, 744	1, 147, 400	2 75	3, 155, 350
Arkansas	248, 900	9 99	2, 486, 511	183, 300	1 90	348, 270	883, 600	2 44	2, 155, 984
Tennessee	340, 800	11 38	3, 878, 304	325, 500	2 00	651, 000	1, 193, 500	3 44	4, 105, 640
West Virginia	237, 600	23 25	5, 524, 200	539, 200	2 47	1, 331, 824	310, 600	4 18	1, 298, 308
Kentucky	357, 500	22 46	8, 029, 450	759, 600	2 88	2, 187, 648	1, 706, 800	5 09	8, 687, 612
Ohio	891, 700	26 59	23, 710, 303	4, 592, 600	2 78	12, 767, 428	1, 734, 900	7 12	12, 352, 488
Michigan	449, 300	27 25	12, 243, 425	3, 416, 500	3 06	10, 454, 490	459, 700	6 80	3, 125, 960
Indiana	788, 100	19 95	15, 722, 595	1, 300, 000	2 41	3, 133, 000	2, 670, 000	5 58	14, 898, 600
Illinois	1, 300, 000	22 03	28, 639, 000	1, 380, 000	2 60	3, 588, 000	3, 034, 608	6 31	19, 148, 326
Wisconsin	435, 900	21 27	9, 271, 593	1, 211, 300	2 34	2, 834, 442	587, 800	5 17	3, 038, 926
Minnesota	310, 900	19 19	5, 966, 171	176, 200	2 38	419, 356	205, 200	5 08	1, 042, 416
Iowa	869, 800	21 44	18, 648, 512	1, 697, 900	2 54	4, 312, 666	3, 398, 200	6 78	23, 039, 796
Missouri	790, 100	14 73	11, 638, 173	1, 366, 200	1 91	2, 609, 442	2, 082, 600	3 13	6, 518, 538
Kansas	476, 700	16 66	7, 941, 822	118, 000	2 37	279, 660	232, 600	3 69	858, 294
Nebraska	79, 000	22 85	1, 805, 150	42, 600	2 55	108, 630	77, 100	4 09	315, 339
California	660, 000	18 92	12, 487, 200	4, 683, 200	2 53	11, 848, 496	403, 700	5 77	2, 329, 349
Oregon	128, 600	14 59	1, 876, 274	634, 400	2 59	1, 643, 096	174, 600	3 73	651, 258
Nevada	44, 500	20 75	923, 375	19, 000	3 00	57, 000	4, 900	8 75	42, 875
The Territories	748, 600	17 14	12, 831, 004	2, 904, 000	3 14	9, 118, 560	107, 900	8 27	892, 333
Total	16, 313, 400	....	304, 858, 859	33, 783, 600	....	94, 320, 652	28, 062, 200	....	149, 869, 234
Grand average of prices	....	18 68	....	....	2 79	....	....	5 34	....

THE TOBACCO-CROP.

Tobacco is a special crop, very irregular in its distribution and fluctuating in extent of local breadth, and hence specific investigation is necessary even to obtain comparative estimates of quantity. Though it is produced in all the States, there were only fourteen States in 1870 (on census authority) that produced (each) as much as 1,000,000 pounds, while several counties in tobacco States yield each two, three, to five millions of pounds. Kentucky and Virginia are credited with more than half of the crop, the former State alone 40 per cent. of it. Only seven States separately exceeded 10,000,000 pounds—Kentucky, Virginia, Tennessee, Ohio, Maryland, Missouri, North Carolina, in order of precedence. Yet in point of fact the product was much greater than indicated by the census, the fear of taxation doubtless preventing a full return. As an instance of deficiency, the national census of Ohio makes a total of 18,741,923 pounds. In 1869 the State assessors returned for the same year 38,953,206 pounds; and undoubtedly neither census obtained a return of the entire production. These seven States produced about 85 per cent. of the tobacco grown.

Few people apparently realize the small area actually occupied by the crop. Allowing 100,000,000 pounds increase over the 262,735,341 pounds reported by the census, twenty townships of land yielding 800 pounds per acre will suffice. This is the size of a medium county. This fact affords an explanation of the necessity of care in preventing great fluctuations in the breadth of production, and shows how easy it would be to glut the market and ruin prices.

An inquiry in the early part of 1874 was directed to our correspondents in counties producing not less than 100,000 pounds, for an actual census or careful estimate of the quantity harvested in 1873, the average price, the number of acres cultivated, and the quality of the crop. Returns were received from a large proportion of them. One county in New Hampshire, Cheshire, in 1870 returned 97 per cent. of all the tobacco reported for the State. Its estimate for 1873 was 200,000 pounds, instead of 151,189 pounds in 1870. It is on the Connecticut River, adjoining Franklin County, in Massachusetts. Three counties in Massachusetts, on the Connecticut, returned in 1870 all but 23,610 pounds of the 7,812,885 pounds made in the State.

Connecticut grows some tobacco in every county, though Hartford is credited in 1870 with 5,830,209 pounds of the 8,328,798 pounds reported. Hartford in 1873 produced 6,000,000 pounds, grown on 3,239 acres, worth 24 cents per pound, of a "fair quality, but not equal to the best on account of extreme drought at planting time." Onondaga, Chemung, and Steuben, in New York, are the only counties reporting 100,000 pounds in 1870, when the aggregate was 1,884,048 pounds of the 2,349,798 pounds in the State. The estimate for the three in 1873 was 2,324,730 pounds, grown upon 2,387 acres. The crop is grown in Steuben "along the valley of the Conhocton River, and is not so perfect in the leaf as the Connecticut." Three counties in Pennsylvania, Lancaster, York, and Bucks, produce nearly all the tobacco grown. An immense increase was made in Lancaster, from 2,792,584 pounds in 1870 to 13,683,600 pounds in 1873 Nine-tenths of the tobacco raised in Bucks County is grown in the immediate vicinity of the old William Penn mansion, in Falls Township, taking the place of wheat.

Coming to the great tobacco States, those of the central belt, we find that Virginia, which twenty-five years ago, and even in 1860, took the

lead in production, has given place to Kentucky, which is credited by the last census with 105,000,000 pounds, and doubtless actually produced 140,000,000 in the census year. Three Atlantic States, with four Western, at one time monopolized the production—how fully may be seen by the following table:

States.	1850.	1860.	1870.	1874.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Virginia	56, 803, 227	123, 967, 757	37, 086, 364	35, 000, 000
Kentucky	55, 501, 196	108, 102, 433	105, 305, 869	34, 500, 000
Tennessee	20, 148, 932	38, 931, 277	21, 465, 452	5, 780, 000
Maryland	21, 407, 497	38, 410, 965	15, 785, 339	16, 500, 000
North Carolina	11, 984, 786	32, 853, 250	11, 150, 087	8, 500, 000
Ohio	10, 454, 449	25, 528, 972	18, 741, 973	13, 000, 000
Missouri	17, 113, 784	25, 086, 196	12, 320, 483	13, 860, 000
Total	193, 413, 871	392, 880, 850	221, 855, 567	127, 140, 000
Other States	6, 338, 784	41, 328, 611	40, 879, 774	51, 215, 000
Grand total	199, 752, 655	434, 209, 461	262, 735, 341	178, 355, 000

This table shows a large increase from 1850 to 1860, if the census returns for 1849 and 1859 are equal in degree of completeness. A superficial observer might assume that decrease in production was heavy in 1869 were it not known that a much larger amount than is reported was handled in the fiscal year ending June 30, 1870. The census returns are 262,735,341 pounds; the exports were 185,748,881 pounds of leaf-tobacco, and manufactured to the value of $1,582,995. The total production could not have fallen short of 360,000,000 pounds. It has been larger since, especially in 1873. The crop of 1874 is really a very small one, as represented in the estimates for that year.

None of the cotton States produce much tobacco. One county in Florida, Gadsden, has long been celebrated for the production of Cuba tobacco, which always commands a high price. A correspondent says of it:

The Gadsden "wrapper-leaf" was always in high repute, and extensively used in the manufacture of cigars, being in size, fineness, and texture fully equal to the best Cuba, and far superior to the Connecticut seed-leaf. Where the variety known as the Cuba-filler has been tried, it has succeeded finely in this county. We need but the capital to manufacture our tobacco into cigars (thus affording us a home-market for the raw material) to make the cultivation of it the most profitable crop that is grown. It is a singular fact, but nevertheless true, that of all the counties of the State, many of them abounding in the very finest soil, Gadsden is the only one that has succeeded in making the Cuba tobacco a staple market-crop. Prior to 1860 it rivaled in net returns the great staple, cotton. Whether this success is attributable to any peculiarity in the elements of the soil I am not able to determine, but this fact is worthy of note, that, except immediately on the banks of the Apalachicola River, which forms the western boundary of the county, there is an entire absence of the rotten limestone which so largely pervades the other sections of the State. In 1872 a citizen of this county cleared one acre of good pine-land, and after breaking it up and applying $8 worth of commercial fertilizers in the hills, planted it in Cuba tobacco. The crop was sent to New York, and the net returns of sale amounted to $320.90. In 1873 he added another acre, making two acres, and planted it again in tobacco. The crop of two acres was sold in New York, and netted $760. The two acres in tobacco did not interfere with the making of an abundant supply of provisions and the usual amount of cotton for market.

THE SMALL CROP OF 1874.

The crop of 1874 is so exceptionally small and poor, from seeding to curing, unpromising and disappointing, that a record of results is deemed desirable. In nearly all of the tobacco districts the destruction of the seed-beds by insects and the drought which dried out the plants before setting or burned them afterward, caused the reduction of the reported area in July more than half. One county in Kentucky, (Adair,)

which grew 2,500 acres in 1873, had scarcely 25 acres planted on the 25th of last June. Low prices also discouraged planting in some sections. The average condition of the crop in Kentucky was 42 per cent. in July, 31 in August, 31 in September, 44 in October, and the indicated product in November was 40 per cent. In Virginia the monthly reports of condition were respectively, 79, 72, 55, and 65, and the product in November averaged 58 per cent. In November our summary said: "The reduced yield of tobacco was sufficiently foreshadowed in our previous monthly reports; all the large tobacco States show results indicating a disastrous year to the tobacco interest;" and a special report, from a careful census of the principal counties, was promised, which is herein presented. It will include the quantity grown, the acreage, the price and total value, the quality, kinds, and uses, mode of culture and curing, and other information.

In 1870 there were 211 counties in the United States producing more than 100,000 pounds each; all others contributed but 12,000,000 pounds, or little more than 5 per cent. of the crop. Of these 211, there are 154, representing in the census 71 per cent. of the total production, that appear in our present exhibit. These counties made a total of 186,276,726 pounds in 1869, and now return 99,805,602 pounds. In the census year 49 counties in Kentucky, which now report 19,306,835, produced 84,593,456 pounds. In 26 counties of Virginia the decline is from 25,000,000 to 19,000,000, while the same counties last year yielded 33,000,000. In Ohio 10 counties gave little more than half the census record, which was very incomplete. The estimate for Montgomery County is 2,500,000 pounds; less than a third of its usual product. Seven counties in Maryland, that produced four-fifths of the crop of 1869, yielded three-fourths as much as in that year, and about six-tenths as much as last year. In Tennessee the business has been nearly abandoned, 9 counties declining in production from ten millions in 1873 to one and a half in 1874. The decline has been small in most of the Connecticut Valley counties; in Hartford County the estimate was six millions in 1873, and six and a half in 1874. The reduction is large in Onondaga, New York, and Lancaster, Pennsylvania. The summary, by States, of the present returns is as follows:

States.	Number of counties reporting.	Pounds, census of 1870.	Pounds, estimated for 1874.	Number of acres, 1874.	Price per pound, 1874.	Value, 1874.
					Cents.	
New Hampshire	1	151,189	173,300	130	20	$34,660
Massachusetts	1	1,095,423	616,000	385	28	172,480
Connecticut	4	7,513,739	8,350,000	6,475	32.3	2,696,500
New York	2	1,408,143	789,670	1,215	13.1	104,054
Pennsylvania	3	3,371,764	9,877,400	8,427	15	1,489,410
Maryland	7	12,536,259	9,568,958	15,553	9.2	886,943
Virginia	26	25,131,788	19,474,980	35,180	12.1	2,224,506
North Carolina	7	6,859,716	4,260,375	12,737	16.3	696,875
Florida	1	118,799	200,000	300	22	44,000
Tennessee	9	10,666,858	1,450,000	2,402	9.7	140,775
West Virginia	5	976,694	488,308	600	14.1	69,313
Kentucky	49	84,593,456	19,306,835	30,025	12.4	2,383,948
Ohio	10	14,662,840	7,680,333	10,638	8.3	404,781
Indiana	3	3,603,043	3,795,000	8,225	9.4	357,150
Illinois	8	3,285,644	1,782,500	1,382	10.9	195,900
Wisconsin	2	875,076	775,000	760	7.5	58,125
Missouri	16	9,426,295	11,216,943	13,843	11.1	1,241,971
Total	154	186,276,726	99,805,602	148,277	....	13,201,391

The details of the above statement, by counties, are as follows:

Counties.	Pounds, census of 1870.	Pounds, estimated for 1874.	Number of acres, 1874.	Price per pound, 1874.	Value, 1874.
NEW HAMPSHIRE.				*Cents.*	
Cheshire	151, 189	173, 300	130	20	$34, 660
MASSACHUSETTS.					
Hampden	1, 095, 423	616, 000	385	28	172, 480
CONNECTICUT.					
Hartford	5, 830, 909	6, 500, 000	5, 000	35	2, 275, 000
Litchfield	1, 048, 569	1, 200, 000	1, 000	20	240, 000
New Haven	103, 562	150, 000	125	21	31, 500
Tolland	531, 399	500, 000	350	30	150, 000
Total	7, 513, 739	8, 350, 000	6, 475	32. 3	2, 696, 500
NEW YORK.					
Onondaga	1, 257, 603	650, 000	800	13	$84, 500
Steuben	150, 540	139, 670	415	12. 2	19, 554
Total	1, 408, 143	789, 670	1, 215	13. 1	104, 054
PENNSYLVANIA.					
Bucks	151, 372	475, 000	475	19	90, 250
Lancaster	2, 692, 584	9, 122, 400	7, 602	15	1, 368, 360
York	527, 808	280, 000	350	11	30, 800
Total	3, 371, 764	9, 877, 400	8, 427	15	1, 489, 410
MARYLAND.					
Calvert	3, 158, 200	3, 150, 000	5, 250	8. 5	267, 750
Charles	2, 102, 739	1, 500, 000	2, 500	8. 5	127, 500
Frederick	274, 369	297, 500	....	13. 5	40, 162
Howard	182, 980	100, 000	200	12	12, 000
Montgomery	630, 000	260, 000	450	10	26, 000
Prince George's	3, 665, 054	3, 000, 000	4, 000	10	300, 000
Saint Mary's	2, 522, 917	1, 261, 458	3, 153	9	113, 531
Total	12, 536, 259	9, 568, 958	15, 553	9. 2	886, 943
VIRGINIA.					
Amelia	1, 037, 721	340, 000	650	11	37, 400
Appomattox	656, 944	400, 000	550	15	60, 000
Botetourt	196, 459	750, 000	1, 500	12	90, 000
Buckingham	809, 937	455, 814	800	12	54, 698
Campbell	1, 761, 901	1, 451, 040	2, 073	9. 5	137, 849
Caroline	417, 848	200, 000	250	10	20, 000
Chesterfield	194, 510	100, 000	400	11	11, 000
Dinwiddie	844, 504	330, 000	660	14	46, 200
Floyd	157, 467	300, 000	800	20	60, 000
Fluvanna	894, 023	800, 000	1, 000	12	96, 000
Franklin	1, 696, 549	1, 500, 000	3, 000	7	105, 000
Hanover	439, 434	109, 858	....	11	12, 084
Henry	1, 129, 617	1, 250, 000	2, 500	22. 5	281, 250
Louisa	930, 226	400, 000	500	10	40, 000
Lunenburgh	963, 673	641, 000	1, 600	10	64, 100
Mecklenburgh	2, 166, 628	2, 000, 000	4, 000	12	240, 000
Montgomery	204, 747	752, 000	1, 250	25	188, 000
Nelson	1, 199, 182	800, 000	1, 000	12	96, 000
Pittsylvania	4, 282, 511	4, 200, 000	10, 000	9. 5	399, 000
Powhatan	541, 430	120, 000	130	14	16, 800
Prince Edward	960, 700	600, 000	1, 500	12. 5	75, 000
Rockbridge	186, 469	150, 000	300	7. 5	11, 250
Spottsylvania	132, 502	75, 000	150	16	12, 000
Cumberland	956, 855	425, 268	567	....	....
Goochland	405, 215	525, 000	....	13. 5	70, 875
Charlotte	1, 964, 736	800, 000	....	....	....
Total	25, 131, 788	19, 474, 980	35, 180	12. 1	2, 224, 506
NORTH CAROLINA.					
Alamance	155, 570	450, 000	1, 200	25	112, 500
Caswell	2, 262, 053	1, 000, 000	3, 000	20	200, 000
Person	1, 227, 150	750, 000	1, 702	30	225, 000
Rockingham	1, 441, 971	1, 500, 000	5, 000	20	30, 000
Warren	751, 045	30, 000	500	11	3, 300

Counties.	Pounds, census of 1870.	Pounds, estimated for 1874.	Number of acres, 1874.	Price per pound, 1874.	Value, 1874.
NORTH CAROLINA—Continued.				*Cents.*	
Stokes	844, 145	400, 000	1, 000	25	$100, 000
Guilford	177, 782	130, 375	335	20	26, 075
Total	6, 859, 716	4, 260, 375	12, 737	16. 3	696, 875
FLORIDA.					
Gadsden	118, 799	200, 000	300	22	44, 000
TENNESSEE.					
Dickson	462, 130	50, 000	100	10	5, 000
Dyer	412, 440	25, 000	45	14	3, 500
Macon	950, 768	50, 000	100	10	5, 000
Obion	645, 937	40, 000	50	15	7, 500
Robertson	2, 103, 322	80, 000	200	13	10, 400
Smith	2, 250, 202	600, 000	757	10	60, 000
Sumner	909, 568	175, 000	300	6. 5	11, 375
Weakley	2, 599, 590	250, 000	600	8	20, 000
Wilson	332, 901	180, 000	250	10	18, 000
Total	10, 666, 858	1, 450, 000	2, 402	9. 7	140, 775
WEST VIRGINIA.				*Cents.*	
Cabell	135, 410	10, 000	20	15	1, 500
Fayette	188, 165	125, 000	200	10	12, 500
Kanawha	412, 469	183, 308	130	12. 5	22, 913
Mercer	117, 429	130, 000	170	20	26, 000
Monroe	123, 221	40, 000	80	16	6, 400
Total	976, 694	488, 308	600	14. 1	69, 313
KENTUCKY.					
Adair	1, 231, 665	150, 000	250	7	10, 500
Ballard	2, 863, 455	984, 485	700	14	137, 828
Boone	279, 740	150, 000	200	8	12, 000
Bracken	4, 188, 039	600, 000	1, 350	17	102, 000
Breckinridge	3, 338, 471	800, 000	1, 100	13	104, 000
Barren	2, 473, 939	900, 000	1, 285	12	108, 000
Butler	1, 008, 582	100, 000	225	10	10, 000
Callaway	1, 924, 502	100, 000	150	10	10, 000
Carroll	669, 875	150, 000	175	12	18, 000
Christian	5, 384, 137	1, 500, 000	3, 000	14	210, 000
Clinton	117, 238	125, 000	250	10	12, 500
Cumberland	1, 304, 366	100, 000	125	10	10, 000
Daviess	6, 273, 067	2, 500, 000	....	12	300, 000
Edmonson	414, 840	50, 000	100	10	5, 000
Fleming	305, 954	140, 000	200	15	21, 000
Gallatin	157, 050	100, 000	130	16	16, 000
Grant	164, 295	200, 000	275	15	30, 000
Grayson	859, 760	275, 000	550	9	24, 750
Graves	4, 474, 195	1, 220, 000	....	13. 5	164, 700
Green	1, 375, 091	211, 250	245	10	21, 250
Hardin	284, 178	20, 000	50	12	2, 400
Harrison	281, 704	166, 500	333	12. 7	21, 145
Hart	2, 315, 212	250, 000	425	10	25, 000
Hickman	570, 287	100, 000	150	12. 5	12, 500
Hopkins	3, 012, 053	80, 000	2, 666	8	6, 400
Kenton	360, 983	250, 000	500	16	40, 000
Larue	368, 100	160, 000	350	13. 5	21, 600
Livingston	1, 086, 578	100, 000	125	11	11, 000
Logan	2, 707, 571	485, 000	970	11. 5	55, 775
Marion	132, 293	9, 600	20	12. 5	1, 200
Marshall	1, 416, 222	40, 000	60	11	4, 400
McLean	2, 262, 037	400, 000	1, 000	11	44, 000
Meade	539, 000	60, 000	75	11	6, 600
Metcalfe	1, 310, 381	100, 000	200	11	11, 000
Monroe	674, 696	100, 000	140	9	9, 000
Muhlenburgh	1, 821, 988	200, 000	300	6	12, 000
Ohio	3, 392, 633	225, 000	450	12	27, 000
Owen	2, 890, 670	800, 000	1, 300	17	136, 000
Pendleton	1, 651, 593	800, 000	1, 600	15	120, 000
Robertson	1, 648, 201	100, 000	125	....	....
Shelby	240, 435	100, 000	125	12. 5	12, 500
Simpson	1, 072, 401	60, 000	100	13	7, 800
Taylor	1, 209, 530	150, 000	300	7	10, 500

Counties.	Pounds, census of 1870.	Pounds, estimated for 1874.	Number of acres, 1874.	Price per pound, 1874.	Value, 1874.
KENTUCKY—Continued.				*Cents.*	
Todd	2, 620, 193	500, 000	1, 000	15	$75, 000
Trigg	3, 614, 363	500, 000	700	12	60, 000
Trimble	658, 465	200, 000	200	12	24, 000
Union	2, 096, 260	2, 000, 000	5, 000	11	220, 000
Warren	2, 035, 159	495, 000	618	8	39, 600
Webster	3, 511, 649	500, 000	833	8	40, 000
Total	84, 593, 456	19, 306, 835	30, 025	12. 4	2, 383, 948
OHIO.					
Adams	102, 473	18, 000	180	19	3, 420
Athens	207, 839	191, 693	272	12. 5	23, 961
Belmont	1, 480, 478	2, 380, 140	2, 411	....	
Brown	2, 687, 743	445, 500	495	....	....
Guernsey	474, 178	150, 000	250	8	12, 000
Monroe	2, 845, 525	500, 000	1, 000	9	45, 000
Montgomery	3, 963, 183	2, 500, 000	4, 000	8	200, 000
Morgan	486, 125	275, 000	550	8	22, 000
Noble	2, 304, 557	1, 200, 000	1, 500	8	96, 000
Vinton	110, 739	40, 000	40	6	2, 400
Total	14, 662, 840	7, 680, 333	10, 638	8. 3	404, 781
INDIANA.					
Dubois	358, 948	1, 100, 000	1, 400	8. 5	93, 500
Perry	224, 125	195, 000	325	7	13, 650
Spencer	3, 019, 970	2, 500, 000	6, 500	10	250, 000
Total	3, 603, 043	3, 795, 000	8, 225	9. 4	357, 150
ILLINOIS.					
Edwards	133, 150	100, 000	130	11	11, 000
Franklin	387, 382	200, 000	230	12	24, 000
Hamilton	471, 860	400, 000	....	11	44, 000
Johnson	307, 013	150, 000	187	9	13, 500
Pulaski	157, 000	32, 500	65	12	3, 900
Wayne	541, 605	100, 000	230	12. 5	12, 500
White	135, 045	100, 000	120	10	10, 000
Williamson	1, 152, 589	700, 000	400	11	77, 000
Total	3, 285, 644	1, 782, 500	1, 382	10. 9	195, 900
WISCONSIN.					
Dane	229, 568	75, 000	60	7. 5	5, 625
Rock	645, 508	700, 000	700	7. 5	52, 500
Total	875, 076	775, 000	760	7. 5	58, 125
MISSOURI.					
Boone	149, 634	75, 000	135	....	....
Callaway	938, 228	1, 238, 200	1, 250	12. 5	154, 775
Chariton	2, 993, 981	3, 500, 000	3, 000	10. 5	367, 500
Franklin	783, 270	401, 270	213	12. 5	50, 159
Howard	788, 132	1, 000, 000	2, 000	9	90, 000
La Fayette	113, 735	35, 000	50	9. 5	3, 325
Lincoln	891, 727	360, 000	400	15	54, 000
Macon	355, 767	350, 000	3, 500	10	35, 000
Monroe	187, 091	500, 000	1, 000	9	45, 000
Osage	119, 617	150, 000	200	10	15, 000
Pike	632, 552	2, 000, 000	....	14	280, 000
Randolph	873, 776	1, 000, 000	1, 400	8. 5	85, 000
Ray	190, 335	280, 000	400	9	25, 200
Saint Charles	146, 754	73, 473	....	9	6, 612
Stoddard	118, 534	54, 000	45	10	5, 400
Webster	143, 162	200, 000	250	12. 5	25, 000
Total	9, 426, 295	11, 216, 943	13, 843	11. 1	1, 241, 971

QUALITY.

Dry weather cured the crop of the northern portion of the Connecticut River in the field, and left it brittle. In the Hartford district there is loss of quality from drought. Part of the crop of Hampden, Massachusetts,

is of extra quality, especially where it was matured early and was warehoused in good order. In the New Haven district quality is fine, but color various; if this unevenness of color is lost in the sweating process, it will be the best crop raised since 1871. In Tolland there was wet weather during the culture, and very dry weather during curing, which proved unfavorable to the best quality. Quality is not superior in Onondaga County, New York, in consequence of wet and cold weather; it is only medium in Steuben, dry weather affecting the leaves somewhat, many of which are injured by worm-punctures. In Pennsylvania the crop is inferior to that of 1873; in Lancaster it grew slowly, and encountered heavy rains when nearly ripe; in Bucks dry weather prevented the maturing of fine leaves, and caused them to dry too rapidly, and contract when housed.

The quality of the Maryland crop is nearly everywhere reported lower than in recent years. In Prince George's it is deemed better than last year, on account of being handled at the proper time, and from favorable curing-weather. It was late in growth and of a dark color in Saint Mary's. Only 60 per cent. is of average quality in Montgomery, from injury by the fly, and the drought of June and July. In Howard there is much immature frosted tobacco. It is thick-leaved, small, and dark-colored in Frederick. Lateness of growth and early frosts were injurious in almost every portion of the State. Similar causes affected a portion of the Virginia crop; that planted before the 1st of June generally was very good; that planted later suffered from drought, and was cut when immature to avoid frost. While a majority of the counties return inferior quality, many others with a smaller area to cure or a more southern location claim a superior crop, as Floyd, Fluvanna, Henry, Patrick, Powhatan, and others. Counties in North Carolina, with few exceptions, have crops of more than average quality. The fly worked among the young plants to some extent, and drought, a severe storm in September, and frost, wrought further injury.

Quality is rather below average in Tennessee, owing to a wet spring, drought, and early cutting to escape frost. In Robertson about half is good; a fourth was cut before it was ripe, and the remaining fourth was frosted in the field. In Mercer, West Virginia, superiority in quality was obtained by favorable weather for maturing and curing. The crop was good in Fayette, and fair in Kanawha, but very poor in Cabell, from early drought. The quality is generally inferior in Kentucky, from the destruction of young plants by the fly, injury from drought, causing imperfect growth and late maturing; so that much was either cut immature or frosted in the field. In some places the early planted was good; in Clinton, one-fourth good, one-fourth medium, and one-half poor. Among the exceptions are Hardin and Meade, above average in color, but light in weight; Hickman, very good; Larue and Clinton, early planted, above average; Graves, good; Pendleton, good fiber, well colored; Owen, above average; Simpson, fine; Todd and Trigg, one-half excellent, the remainder frosted.

Counties in Ohio return comparatively poor quality. Montgomery had one of the poorest crops ever raised. A small insect destroyed a large portion of the plants in Vinton. Fifty per cent. deterioration is returned from Monroe. Late planting and subsequent drought were prominent causes of poor quality. In Washington the crop is claimed to be good. In Indiana and Illinois the quality is quite uniformly good; it was in some counties more carefully cultivated and handled than usual. Drought injured the Wisconsin crop. Most of the Missouri counties make favorable report of quality, many indicating an improvement over last year, and some admitting injury from drought.

VARIETIES AND USES.

Few, if any, plants are so modified by peculiarities of the soil on which it is grown, and by circumstances of fertilization and culture, as tobacco. Whether the crop is worth in market five cents or fifty per pound depends more upon these points than upon the variety grown. And yet there are many varieties, showing the most marked points of difference. Fashion, as to color and other points, contributes to widen the range of prices.

The Connecticut seed-leaf, used for wrappers for Havana fillers, and lower grades of fillers, or binders to cheap cigars known as seed-cigars, is cultivated almost exclusively in New England, *i. e.*, the Connecticut Valley, from Cheshire County, in New Hampshire, to the sea. The Housatonic Valley, in Connecticut, has recently made this crop somewhat prominent; and, by a superior system of warehouse classification, it realizes returns almost equal to those secured on the Connecticut. In the town of Westfield, in Hampden, Massachusetts, the Havana seed is grown, said to be a cross of the Connecticut with Havana; a plant of firm leaf, better flavor, and greater value for wrappers of fine cigars than the broad-leaved common variety. In the vicinity of Hartford are varieties bearing the names, Connecticut seed-leaf, broad seed-leaf, Belknap, Puritan, and Ohio broad-leaf.

The Connecticut seed-leaf is the kind grown in New York, almost exclusively in Onondaga, Chemung, and Steuben. The best quality is used for cigar-wrappers; and the coarser and imperfect stock is manufactured into smoking or chewing, and some of the refuse is ground into snuffs. A cross from Havana seed is mainly grown in Bucks County, Pennsylvania, much resembling imported Cuba tobacco.

The Maryland tobacco is of two principal varieties, the broad-leaf and the narrow-leaf. The former commands a higher price; the latter yields a larger quantity. Much of it is exported; a large order is usually filled for the French government. It sells at a moderate price, has no peculiar value for wrappers, and is used for cigar-fillings, ordinary snuffs, twist and plug chewing, and for manufactured smoking-brands. In Montgomery County a kind known as Bay tobacco is grown. The Big Pryor variety is deemed the best in Botetourt County, Virginia; the Blue Pryor is popular in Amelia. The White-stem, a dark-colored shipping-tobacco, is quite extensively grown in strong, heavy lands, finding a good market in England. The Cumberland correspondent claims that as the banner county for shipping and stemming tobacco. A fine grade of tobacco is made from Orinoco seed. The Frederick, a vigorous grower, is cured to a dark "nutmeg color," and is principally shipped to Europe. The crop of Montgomery has a large leaf which cures bright, and is useful for wrappers, with careful assorting. The red lands generally produce too coarse and strong a quality for cigars or fine chewing-brands, but suitable for shipping. Several kinds are grown in Henry, but growers aim to produce a bright, yellow leaf, suitable for plug chewing-tobacco. The new lands, and old fields on which fertilizers are used, yield a light yellow, manufacturing grade.

The soil of several counties in North Carolina, near the Virginia line, is peculiarly adapted to the production of light-colored and high-priced wrappers. Person, Caswell, and Granville claim to "surpass any other portion of the United States in adaptation to the growth of the first and most remunerative grades of tobacco." The average price of the last crop in Person County is placed at 30 cents, of the Gooch, White-stem, Yellow Pryor, Big Orinoco, and Little Orinoco varieties. The first is distinguished by fine texture and small fiber, and is successfully grown

on light, sandy soil, almost valueless for grain or grass, and brings from 40 cents to $2 per pound for wrappers. The White-stem is second in quality, Yellow Pryor third, and Big Orinoco fourth. The respective area of each in cultivation widens in the order named, except that the Pryor's liability to injure from frost is driving it from the field. All these are usually coal-cured and used for wrappers. The Little Orinoco is coarse-grained, grown on rich soils for weight rather than quality, not adapted to yellowing, and air-cured or dried with wood-fires, is used for fillers, and sells at 15 to 25 cents. It is reddish brown in color; sometimes nearly black. In Caswell the broad-leaf Orinoco is most cultivated, though some prefer the Yellow Pryor variety, less in weight and richness, but of finer texture. Light lemon-color commands the highest price. The White-stem and Orinoco are mainly cultivated in Stokes.

Gadsden County, Florida, has produced for forty years a variety grown from seed obtained in Cuba, having a small, narrow leaf, and possessing to a remarkable degree the peculiar aroma and delicate fragrance so highly prized in the Havana cigar. Since the advent of German buyers an article was introduced which produces the "Florida wrapper," and is now the main growth. Its leaves are sometimes three feet in length and twenty inches in breadth, of a fine silky texture, admirably adapted to use as wrappers, the coarser leaves being used very acceptably as fillers. Another variety, medium in size, introduced since the war, highly aromatic, even somewhat pungent, makes a strong cigar.

There are different varieties in Tennessee, as the White Stem, Big Stem, Big and Little Frederick, Blue and Yellow Pryor, Orinoco, yet when grown several years they appear to assimilate in quality and appearance. Much of it is cured a red or mahogany color and finds a large sale in European markets.

Kentucky, the tobacco-field of America, has many varieties. That grown in Christian, Trigg, Todd, Logan, and in Stewart, Montgomery, and Robertson, in Tennessee—known to the trade as the Clarksville district, though Hopkinsville is now a rival point for the traffic—has a heavy body and is well adapted to the export trade; it is largely used in Germany, Austria, and the north of Europe, though a portion is sent to Mexico and the coast of Africa. It has no competition in the West, and is only approximated on the manured lands of Virginia. The soil on which it is grown is limestone, with a deep-red clay subsoil. Its peculiar mode of curing contributes largely to its recognized characteristics. It is cured in close barns in the course of two or three days' heavy firing, which gives greater body than the air-cure. The White Burley is a favorite in many counties, among which are Bracken, Fleming, Pendleton, Grant, Shelby, Trimble, Kenton, and others. This is cured of a bright-yellow color, and is used for cutting into "fine-cut," and sometimes for wrappers. Old land, well manured and cultivated, will yield a heavy shipping-tobacco from almost any variety; and a red or black oak soil will make a bright wrapper from the same varieties. Fleming County is working exclusively for the cutting-trade. Good chewing grades are made from the Yellow Pryor and the Long Green in Hardin; and the Pryor is also the favorite variety in Hart, in Muhlenburgh, and in Adair. The Little Frederick is most grown in Clinton. The one sucker variety, producing only one sucker to the leaf, is favorably regarded in Adair, Clinton, Hart, and other counties. Cumberland produced good shipping-leaf; Hickman grows shipping-grades used largely in plug-tobacco; that of Hopkins is manufacturing and shipping, and about one-fourth of the crop is made into strips; and ship-

ping-leaf is prominent in Logan, sought by English and French buyers, for wrapping and manufacturing purposes. There are many other names of assumed varieties, but the above are among the best known.

The leading variety in Montgomery, Ohio, the Baltimore Cuba, is from seed sent out by this Department. It has a long and broad leaf, and when properly cured makes good wrappers. "This seed has been worth millions to the county," says our correspondent. The white tobacco, grown in Adams County, is used for wrappers and fine-cut. The Monroe crop is similar to the Maryland tobacco, and goes to Europe for smoking-tobacco. It is used to some extent in the manufacture of cigars. The Connecticut seed-leaf and the Kentucky are the best varieties in Vinton. In Spencer, Indiana, the Pryor is grown for fillers and black wrappers, and the White Stem and Twist-bud are shipping-leaf sorts. The White Burley and Yellow Prior are favorite varieties in Edmunds, Illinois; in Johnson, three kinds are grown, the Pryor, the Big Shoe-string, and Big White Stem, the two latter yielding most; that grown in Southern Illinois is mainly used for fillers and wrappers and in the cutting-trade. The Crown-leaf, in Rock County, Wisconsin, is exported, though choice lots are taken at home for wrappers and binders for cigars. The Yellow Pryor appears to be largely grown in Missouri for the shipping-trade. The Little Frederick, Twist-bud, Long Green, and Fine Small are other desirable varieties, the latter liked by many experienced and careful growers. That grown in Boone County for exportation ranks high as a chewing-tobacco.

ROTATION.

A sort of irregular rotation is to some extent practiced in the Connecticut Valley. In the vicinity of Hartford it is customary to take off from one to three crops of tobacco, then a hay or grain crop, followed by grass for several years. Lower down the valley rotation is observed to some extent, and the general testimony accords therefor better returns. Our Hampden (Massachusetts) authority deems the quality better if repeated crops are taken.

In the Onondaga (New York) district a clover sod, with a good spring growth, and fifty to sixty loads of manure per acre, all well turned under and reduced to a fine tilth, is the favorite soil for tobacco-planting. Wheat is the next crop. Sometimes crops of tobacco are repeated, with eighty to one hundred loads of manure per acre, but more than two or three crops are indicative of bad farming. In Steuben the preferred order is clover, corn, tobacco. In Lancaster, which county produces a large proportion of the crop of Pennsylvania, tobacco is preceded by corn and followed by wheat. The rotation in York is similar. Quite uniform Maryland practice is to follow tobacco with wheat. In Calvert County it is grown every third year, the crops being clover, tobacco, wheat. It is preferred in Charles to have it follow corn rather than "a fresh fallow." New land in Frederick, after a crop of tobacco, is sown to wheat, then grass. Three crops are sometimes taken from new land in Montgomery, but further continuous cropping results in larger plants of inferior quality. The regular three-year rotation is generally practiced in Prince George's, though some planters prefer the four or five year plan. Where new land is taken for tobacco in Virginia, two or three consecutive crops are usually taken, followed by wheat, afterward clover or grass. In old ground the common rotation is clover, tobacco, wheat; in some counties wheat precedes tobacco; where only two fields are used, which get all the manure from stables and cattle-pens, the crop is only alternated with wheat. Corn comes in between tobacco and wheat in Patrick. In some

counties a year or two of fallow comes after wheat; in other counties a similar rest follows two or three consecutive crops of tobacco on new land. New land is preferred in North Carolina, and soils peculiarly desirable for particular kinds and qualities of tobacco are selected with great care. No attempt at rotation is reported from Florida. A systematic course of cropping is by no means the rule in Tennessee. Wheat is most frequently grown after tobacco, but corn or other crops sometimes occur in succession. On new land wheat is sometimes grown between two crops of tobacco, followed by a similar period in corn, wheat, and clover. Old ground is manured for the tobacco-crop. Fertilizing for tobacco is virtually unknown in West Virginia. Wheat, as elsewhere, is usually adopted for the succession, followed by clover, on the best-managed lands; but the more careless farmers follow with promiscuous cropping until the land is exhausted and turned out to grow mullein, pennyroyal, and rag-weed. Some sort of rotation is deemed a necessity in Kentucky, though some counties do not practice it; it is held that to grow the crop "on the same ground two or three years in succession would everlastingly ruin it;" also that it cannot be successfully grown on timothy-sod; but that it may be cultivated in successive crops by sowing rye and turning under in spring when a foot high. The preferred course appears to be tobacco, wheat, clover; if longer, two years in clover. In Ohio several crops are in many cases grown in succession; sometimes two of tobacco, two of corn, and one of wheat, and then grass or tobacco again; in other places tobacco, wheat, clover, as in other tobacco-regions. Farther west, where new lands are abundant, tobacco-growing is either confined to such lands, or alternated with wheat, with little thought of any regular course of rotation.

CULTURE AND CURING.

A comparison of the local modes of culture and curing reveals great differences in the *modus operandi* of tobacco-husbandry.

The cultivation in Cheshire County, New Hampshire, substantially the northern limit of Connecticut Valley tobacco-growing, is essentially the same as in Massachusetts and Connecticut. The soil is a warm, sandy loam, manured with ten or twelve cords of stable-manure and two to five hundred pounds of guano per acre, harrowed in. The surface is ridged up to bring the manure around the plant. Sometimes the ground is lightly marked with the plow, and guano or superphosphate of lime placed in the hill. When the plants are set they are mulched with straw or hay to prevent their withering. In Hampden, Massachusetts, ten cords of good manure, horse-manure preferred, are applied. At the time of transplanting, which occurs from the 5th to the 25th of June, the land is plowed, and then a light furrow is cut, sowed with 300 pounds of guano or superphosphate, and covered with ridges, leaving the rows somewhat elevated. The Havana plants are set 18 inches by 3 feet, the seed-leaf 2 feet by 3. The yield of the former does not equal that of the common sort. The seed is usually sown in April in Connecticut, in a carefully-prepared seed-bed liberally manured with a rich compost or concentrated fertilizer. Horse-manure for the field-culture is obtained as far as possible, and supplemented with any available well-decomposed farm-yard manures, and also with Peruvian or fish guano, superphosphates, wood-ashes, bone-dust, tobacco-stems, and other fertilizers. The ground is plowed and harrowed sufficiently to pulverize and mix the fertilizers. The plants are set in Hartford County from July 1 to July 10, in rows 3½ feet apart, and from 18 to 25 inches

in the row. The best cultivation is given; the seed-blossoms and all suckers are broken off; the plants are cut in August or September and left on the ground to wilt; then bundles of five to seven plants are strung on a lath, four feet long, and hung in the curing-house in tiers.

The district known as the Housatonic Valley comprises all of Litchfield County, five towns in Fairfield, two or three in Berkshire, and one in New Haven. Low prices have reduced the acreage to a lower figure than for eight years past, and the product is estimated at 3,500 cases, of which Litchfield produced 3,000 on about 1,000 acres. This district has had considerable experience with special fertilizers, and the conclusion is reached that they aid the growth of the plant while injuring its quality. At the present time most of the crop is grown with barn-yard manure, yielding a product of better color and texture, and one that comes out of the sweat better than that made with such special fertilizers. In New Haven the main resource for fertilizers beyond the common use of farm-yard manure is a double-refined poudrette. In Tolland the liberal use of horse-manure, say eight to ten cords, with 350 pounds of guano per acre, is deemed sufficient to keep up soil-fertility without rotation.

The main reliance in Onondaga, New York, is upon clover-sod and farm-yard manure, though various kinds of commercial fertilizers have been used. Our correspondent says, "Three acres of tobacco will require the manure accumulated from 100 to 200 acres." In Bucks County, Pennsylvania, the tobacco-section is Falls Township, along the Delaware River, where the surface is nearly level, and the soil a rich, dark, sandy loam. During the winter 35 loads of manure per acre, brought in boats from Philadelphia at $1.25 per load, are spread upon the fields, and plowed under at a depth of 4 to 6 inches as soon as frost is out, and left till about May 20, when the soil is well pulverized and worked into hills 3 feet apart each way. A compost of well-rotted manure is applied in the hill. Fertilizers are believed to injure the burning qualities of the leaf, and their use has been discontinued. The culture is similar to that of cabbage, until the leaves are 6 inches in width, after which the fields are gone through two or three times per week in search of worms, which do not increase in abundance from year to year. The crop should be cut in twelve weeks from planting. In Lancaster, the largest tobacco-county in Pennsylvania, plants are set 20 inches apart in the rows, which are 3½ feet apart. The culture is about the same as for corn; the soil is kept well pulverized and free from weeds. Farm-yard manure is the main fertilizer, which is so extensively used that other crops suffer from lack of it.

In Maryland, seed is germinated from January 1 to March 15, in a well-prepared bed, enriched with barn-yard manure and Peruvian guano. As the plants attain the size of a man's hand they are transplanted when the earth is moist from rain. The distance apart varies somewhat, 2½ feet each way being the usual distance in several counties; in some cases 3 by 2 feet; in Prince George's 3 by 3 feet. In Calvert the land is well fertilized with farm-yard manure, guano, and superphosphate. When the plants begin to grow, the crust around them, with the starting grass, is scooped away with the hoe; this process is called weeding. Subsequent cultivation consists in stirring the soil every eight or ten days with a one-horse cultivator, as long as it can be done without injury to the leaves. When the blossoms appear the top is broken off, and the plant is allowed to stand until mature, when it is cut and hung on poles in the barn to cure. Suckers are broken off and worms killed during the growth. It is cut between August 20 and October 20, the

first cut being the best. In Prince George's, growers prefer to plow both in fall and spring. They want very rich beds to start the plants, but do not care for heavy fertilizing of fields. They use guano, Turner's Excelsior, and the Old Dominion fertilizer. In Saint Mary's 20 to 30 loads of manure with 300 pounds of superphosphate per acre are spread in drills.

The housing and curing is thus reported in Calvert: When the leaves are sufficiently mature, and soft from moist weather, they are stripped from the stalk and tied up in small bundles, care being taken to keep the several qualities separate. When in proper condition these bundles are packed in hogsheads for market. Nearly all the crop is air-cured; a few planters use the curing apparatus of Bibb & Co., and by proper care and attention produce a superior article. In Montgomery, when cut it is hauled to the house and hung on sticks 4½ feet long. On one end of these sticks is an iron spear, on the point of which the plants are pressed, while the other end is made fast in the house, and thus about ten plants are strung upon each for curing, the sticks being hung 10 to 12 inches apart upon poles. Fires are kindled beneath the tobacco, which is hung 10 feet above. The curing process requires great experience to secure the desirable color, and caution to prevent the burning of house and tobacco together. The fires are kept up till the tobacco is thoroughly dry. It is stripped from the stalks in damp weather and assorted, usually making four grades, yellow, spangled or red, ground leaf, and tips.

The following extracts from Virginia returns give a variety of information on culture, fertilizers, and curing:

Amelia: Land is sometimes, but not often, checked, or laid off both ways. When not checked the beds are thrown up with two furrows of a double-turning plow, and usually about 250 pounds applied to the acre of some one of the commercial fertilizers in the market; everybody uses different, changes every year, and alternately praises and blames. All agree in this, that there is no money in the use of them, either in the first or any subsequent crop; all agree that the commercial fertilizer has been a curse to the land instead of any benefit. What little stable-manure is raised is spread on the land before marking off. The ridges being up, hands with flat hoes pass along, and at intervals of 2½ to 3 feet strike off the crown of the bed and press it with a short blow from the flat of the hoe. In May or June, so soon as a rain has fallen and a "season has come," the plants are set, one in each hill. They live easily, and if the plants are of tolerable size, and no insects attack them, a stand is secured without difficulty. So soon as the plants give signs of growth in their new places, a 3 or 5 tooth cultivator is lightly run twice between the rows, one tooth being guided as near to the line of plants as possible without covering or disturbing them. Hoes follow, gently breaking the crust around the plant. This is a weeding operation, and if omitted serious consequences sometimes follow. Fields under a nice rain and warm sun become as a carpet in one week, with a grass here called "crab-grass." It incloses the plant and cannot be removed without imminent risk of death to it. This is the critical period, and if passed in safety the planter regards his crop safe. After this, until the 25th of August, the ground is kept stirred with shovel-plows, and kept level, or nearly so. The plants being now up, "primed" and "topped," single-turn plows are put in with four furrows to the row, the soil thrown up as high around each plant as the plow will heave it. By some this is not deemed sufficient, and they cause hoes to pass over the field, drawing the soil still higher up around the stalks of the plant. This sometimes proves of great benefit. The winds of the equinox, accompanied with soaking rains, are prevented from throwing the plants down into the mud. After this last hilling no further cultivation is required. The last of August and the whole of September is spent in quest of worms. *Appomattox:* Cultivated chiefly on newly-opened land without fertilizers, and upon lots with farm-yard manure. *Botetourt:* For old land, deep plowing, hilled with a two-horse plow. Our best farmers say it pays well to use a fertilizer, dropping a small quantity in the hill. *Caroline:* The beds for seed require the same preparation as for cabbage-beds; sow as soon after the 1st of January as the ground is in order; transplant as soon as the plants have sufficient roots to sustain them; say the last of May or first of June. When the crop is planted out early, so as to ripen before the frost, and is kept clear of grass and

worms, we never fail to make a fair crop. Various fertilizers are used; the one generally preferred is a preparation for tobacco by the Old Dominion Fertilizing Company, Richmond. *Chesterfield:* Land well plowed, stable-manure spread, listed both ways, the hills 3 to 3½ feet apart each way, flattened with the hoe; in season for the plants as early as they are large enough; and "a bud in May is worth a plant in June;" unceasing vigilance required in August and September to prevent its ruin by worms. *Cumberland:* Our leading idea is, to make a *heavy, rich, long* plant, either very early for the stemmers, or later in the season for shipping. The soil and climate are remarkably suited to tobacco, and by heavy manuring and thorough cultivation, 2,000 pounds per acre may be raised. *Dinwiddie:* Plow the land early in winter; in April spread on it all the manure we can find, from stable, farm-yard and pig-sty, and plow it under; cross-plow and harrow early in May; mark off hills 3½ feet apart and fertilize at the rate of 300 to 500 pounds per acre, by hand or drill; then bed up the land, four furrows together, mark across 3 feet apart, and chop and smooth with the hoe midway between the checks. Plant as early as practicable after the 10th of May. When ready for topping, the best farmers always prune off the small leaves at the bottom, and break out the bud, leaving 8 to 12 leaves, according to the strength of the land or the time of topping. If planted any time before the 12th of June the farmer can select his own time for cutting, but if later he must beware of frost, or cut his crop green. We use all kinds of fertilizers. Peruvian guano acts better than any other. Our barns are principally built of round logs, the spaces being pointed with clay-mud to make them close. These are considered the best for curing, as they retain the heat better. To make dark stripping, or fillers, we commence firing as soon as the tobacco is housed, and keep the fires up for three days. It is only rich, strong land that makes this class of tobacco. To make red wrappers or fillers we put the tobacco in the barn, allowing plenty of space, and using no fire except in very damp or rainy weather to prevent mold. This tobacco is grown on almost any variety of soil, the richer the better. To cure bright wrappers, plant on light-gray soil in fair condition as to fertility. Let the tobacco ripen on the hill before cutting; if the weather permits, scaffold three days in the sunshine, then put in the house and start fires of *charcoal*, slow at first, and gradually increased to the desired temperature; keep the heat at this point until the leaf-stem and stalk are thoroughly dried. Wrappers cured by this process are known as "coal-cured wrappers," and sell for 40 to 120 cents per pound. *Fluvanna:* A great portion of so-called fine, or high-priced, tobacco is grown on light-gray granite land. This is of a light yellow or brown color and rarely grows to a large size. It is often planted on new ground or lands that have grown up in pine. We have also strong, heavy lands on the Rivanna and James rivers which produce a coarser and larger growth of tobacco adapted to what are called strippers, and wanted for the English market. Our most successful tobacco-growers use fertilizers at the rate of 300 or 400 pounds per acre, with or without farm-yard and stable manure. *Henry:* Old ground not often planted in tobacco more than once; new ground twice. Stone flues are generally used in curing, but charcoal-curing is growing in favor. *Louisa:* The two principal things are, to get the plants out early in May, if possible by the 15th, and to keep the crop well worked. An early stand insures against frost. The most popular fertilizer is that known as "Gilham's;" but it is sold too high, $70 per ton. It is generally sown at the rate of 300 pounds to the acre, and with a small amount of stable-manure acts well. *Lunenburgh:* Land for raising the plants is prepared by thoroughly burning in the latter part of December or early in January; the seed sown soon after. In a favorable season the plants are large enough for transplanting about the first of May. For the crop new or fresh land is usually taken. To insure a good stand, the transplanting must be in wet weather. *Montgomery:* Seed-beds prepared in January and February by burning the ground thoroughly; the earth and ashes well mixed and pulverized; the seed brushed in; the ground tramped or packed, and covered with a thin layer of brush. A wet season is indispensable for setting the plants. When the tobacco attains a sufficient size and number of leaves, the lower leaves are stripped off to the height of about eight inches, and the top taken off, leaving eight or ten leaves growing on the stalk. No fertilizers are here used. *Nelson:* Soon as the plant is large enough it is topped from eight to ten leaves, after taking off three or four of the bottom leaves. Soon as topped it begins to throw out suckers or sprouts just above each leaf. Then comes "the tug of war" to keep the crop clear of suckers and horn-worms. This requires the entire crop to be gone over, and each plant carefully examined about once a week. Fertilizers—such as bone-phosphate, Eureka tobacco-fertilizer—are used to some extent; but stable manure is universally preferred, as being cheaper and more reliable. The ripe plants are cut out from time to time as they ripen, and are either hung up in the sun for two or three days, or carried, as some prefer, immediately to the house. After wilting for several days, and until yellow spots begin to show on the leaves, slow fires are made under the tobacco, and gradually increased until the leaf is entirely cured. *Powhatan:* Stable or cow-yard manure is generally spread on the land, and plowed under in the fall, and the land

refallowed in the last of April or first of May. The most popular fertilizers are the Pacific soluble and Gilham's tobacco-fertilizer. *Pittsylvania:* Commercial fertilizers are used. It is supposed that barn-yard manure will not produce as fine quality of tobacco as some artificial fertilizers, though it is acknowledged that most of these are not beneficial to the land. *Prince Edward:* As the season advances the plants are pruned and topped lower, leaving a smaller number of leaves, in order to bring a uniform ripening, as far as practicable. The tobacco is cured by making fires of logs on the floor of the barn, extending across the floor, and four or five feet apart. Peruvian and soluble Pacific guano are most used. Soft gray land is selected for the plant-beds, and prepared for the seed by burning with wood cut for the purpose. *Spottsylvania:* Peruvian guano and other fertilizers are extensively used. Old land manured makes a thicker, heavier leaf than fresh or new land from the woods. New land will produce only three-fourths as much in quantity as old. Not half the tobacco-growers put out a single plant, the fly having destroyed all the plants; but a few made better crops than for years. When the tobacco-bed was made beside a running stream, and a ditch cut around the bed, making it on an island, the plants escaped the fly.

The coal-cured tobacco of North Carolina is cut when it begins to yellow in the hill. In the barn it is first heated gradually until the leaf is nearly cured, when the temperature is raised to 175°, and kept at that point until the cure is complete. Heavy fertilizing is avoided for the bright, charcoal-cured, high-priced grades, to obviate the danger of a dark color and bad bloom from too much sap. On this account it is grown usually on new land, in a light, gray soil, for two consecutive years after the removal of the forest, with a small quantity of fertilizers, if necessary, to give the plants sufficient size. In Warren, seed-beds are made by burning a moist, rich bottom, dug thoroughly four to five feet deep; the seeds are raked in quite shallow, the bed trampled with the feet, and covered with brush. Well-decomposed stable-manure is freely applied as a top-dressing to the plants, to keep up a high temperature, to hasten growth, and prevent the depredations of the fly; and in some cases, tobacco-stalks, chopped fine, Peruvian guano, hen-manure, and hog-hair. While fertilizers of all sorts are used in field-culture, the main reliance of the best farmers is found in farm-manure and wood-ashes.

In Gadsden, Florida, "the heretofore prevalent opinion that freshly cleared land was essential to the production of a fine quality of tobacco is fast giving way as the result of experience, it being found that successive crops may be grown on the same land without any deterioration in quality, so long as the fertility of the soil is maintained at its original standard and it is kept from being fouled with grass and weeds. Usually upon lands appropriated to tobacco no fertilizers are used for the first and second crops; after that a compost of barn-yard manure and cotton-seed, applied in the hill, is found to give the best results. In cultivation, if a lighter article is desired, the plow may be dispensed with after breaking up the land, and the cultivating done with the hoe. If a thick, heavy leaf is desired, the plant is topped so as to leave twelve or fourteen leaves; if a lighter article, it may grow until it begins to throw out the seed-branches."

Fertilizers are little used in Tennessee; growers in certain counties have scarcely heard of their use. New land is their main reliance. In Smith, where the soil is very fertile, "the practice of the tobacco-raiser has been to begin at the bottom of the hill, clear off a few acres, put them in tobacco from year to year till they become exhausted, and then go up the hill a few acres higher; thus wearing out, as it is called, and too truly, one field after another, until the tobacco-growing part of the county, which is a little more than half its area, is greatly exhausted."

In West Virginia tobacco is grown almost exclusively on recently cleared land, the best crop being obtained the second year, without fertilizers, and a sure crop of wheat follows.

Kentucky, the great tobacco State, is thus reported on the points of culture and curing:

Adair: The best piece of ground the farmer has is set apart for tobacco. It has for a long time been the habit to clear up a piece of woodland and plant it in tobacco until it is too poor to produce that crop; but since most of the good timbered lands have been cleared out, the farmers use manure to produce the crop, generally placing a good spadeful in each hill. If the season is wet, manure increases the crop greatly; but if dry, it burns it, and is not of much use. *Ballard:* No fertilizers used. *Bracken:* We use no fertilizers except well-rotted stable or barn-yard manure, which does well on old land. But new ground is best for tobacco, except for the finer qualities, and to this end farmers are constantly clearing up new land and old thickets and waste-places for fresh soil. *Christian:* The best lands are selected, as tobacco will not grow to any profit on poor land. Manure from the farm, but no fertilizers used. *Clinton:* No fertilizers except stable-manure. *Cumberland:* A large amount of our tobacco is cured without firing. *Edmonson:* Generally new ground is used for tobacco and then planted in corn. *Fleming:* The crop from new land is always superior in quality, and farmers endeavor to clear up a sufficiency for it. *Grant:* No fertilizers used. *Grayson:* My neighbor's ground and mine were about equal in condition, planted about the same time, and the crops grew very much alike until topping, worming, and suckering commenced. Difference in management after that caused the following results: My six acres made 5,600 pounds; his twelve acres, 5,300 pounds. *Graves:* The best tobacco raised on new land. No commercial fertilizers used. *Hardin:* Grown on new ground, without any fertilizer. *Hart:* Generally raised on new ground, and no fertilizer used. Stable-manure is used on thin soil. Let it stand until thoroughly ripe; cut and handle very carefully; house immediately in close barns; place several charcoal fires in each room, and keep them up until the tobacco is perfectly yellow, or, as some term it, white—the lighter the better. Then increase the fires, and continue them until the stem is perfectly cured and dry. This produces a fine wrapping-leaf, worth 20 cents to $1 per pound. Flues and other modes of curing have been much used, but all growers who have tried it now conclude that the method of charcoal-curing is preferable to all others. *Henry:* The very best lands available are selected; new land preferred; but frequently a series of crops is taken from a newly-cleared field before it is too much exhausted to render further cropping in tobacco profitable. Then it is put in small grain and grasses, and is soon renewed. No fertilizers are used. *Hickman:* No fertilizers are used, as the ground used for tobacco is mostly fresh land, and seldom planted in tobacco more than two years. *Hopkins:* No fertilizers used. *Larue:* No fertilizers on new ground; on old, stable-manure well rotted. Rarely grown on the same land more than twice. *Livingston:* Mostly grown on new land; when on old, it is enriched by barn-yard manure. *Logan:* Farmers use little or no commercial fertilizers. They select new ground, or the best old they have, and use as much manure in the hill as they can scrape up from the stable, barn-yard, &c. *Mason:* Generally cultivate new ground, and use no manure; or, if any, stable-manure. *Marshall:* No fertilizer, except barn-yard or stable-manure, when raised on land which has been cultivated a few years. Generally raised on fresh land. *McLean:* When old land is used, barn-yard manure is put in the hill or spread; no other fertilizer used. *Meade:* Generally clear up fresh land, but some plant on old by using manure from the stable. *Ohio:* Fertilizers seldom or never used. Fresh ground is generally selected and cultivated in tobacco three years, and then some other crop is cultivated. *Owen:* Fine tobacco must be grown on fresh but thin land; usually an oak-growth is best adapted to it. Nothing is used in the curing except to let it hang under a shed where it is not exposed to sun or rain. No fertilizer used. After being cleared up, the ground is usually put in tobacco two or three years, and then not again till after years of rest in grazing. *Pendleton:* Generally cultivated on new ground; no fertilizers used. *Robertson:* Use no fertilizers; either plant on new ground or sod-land. Four-fifths raised is on the former, which will stand two crops in succession. *Shelby:* Generally, though not exclusively, cultivated on new or fresh lands. White-oak lands are the best for a fine article. No fertilizer is used except stable-manure, and that seldom, as its product is a dark, coarse article, not very salable. The plants are not allowed to blossom before they are topped, as recommended by writers on tobacco-culture; it would be too exhausting to the plant; topped as soon as they have as many leaves as will mature before frost. If set out early, twelve to sixteen leaves are left; if late, a less number. If the season is not too wet, fire is seldom used in curing in the tobacco-house. *Simpson:* No fertilizers used except barn-yard manure and wood-ashes. *Todd:* Stable-manure is used on old lands. Follow clover with tobacco when we do not have fresh-cleared lands. *Trigg:* Usually set in ground newly cleared, but latterly farmers are rotating their crops; tobacco first, then wheat, with clover and timothy; the third and fourth years the hay is cut and the land pastured, then planted in tobacco again. No fertilizer except stable-manure made on the farm is used. *Warren:* The best land is generally selected for the crop, and barn-yard manure only is used. *Webster:* Well-rotted stable-manure the

only fertilizer used. *Boone:* No fertilizers used. *Gallatin:* Generally planted on new land or old soil, and no fertilizers used. Bad peculiarities mostly proceed from bad culture: First, neglecting too long to thoroughly work the plant after setting, causing it to run up in a spindling manner and the main stalk to harden and make no leaf. In such case the best plan is to cut the plant off at the ground, leaving one leaf and bud for a second plant, which, properly cared for, may yet make good tobacco. A second cause is too much wet weather after the plant starts to grow, causing it to "French," as we term it: the leaf thickens, grows very narrow, dagger-shaped, frequently not broader than a case-knife, and often as many as fifty leaves on a plant, all of them spread out on the ground. In this case the best plan is to pull the plant up, as it is worthless. *Carroll:* The White Burley takes its name of "white" from the peculiar whitish appearance of the plants just before maturity. There is nothing different in the mode of cultivation from the old kind, except that it is desirable to plant on new ground. The plants then grow rapidly and mature before the sun has lost its full warmth, thereby insuring the light and bright color which is so desirable with purchasers. The beds should be sown as soon as the ground is dry enough to work, the land well prepared by plowing and harrowing, a ridge made by throwing three furrows together, three feet apart, and marked across same distance, that the crop may be mainly cultivated with the plow. The plants are topped at from twelve to twenty leaves. The time for cutting can only be learned by experience, but will be indicated by the breaking of the leaf when pressed between the fingers. After it is cut and hung on scaffolds out of doors, it should remain so, exposed to the sun, for ten days, or until the leaf has acquired a bright yellow hue. It must then be put under cover, in a house not ventilated, so that there may be no danger of "house-burning." This kind of tobacco has been sold this year at from $15 to $25 per cwt., and often as high as $50, when prepared for market with care.

Fertilizers are not used in Ohio when new land is cultivated; farm-yard manure is preferred, and used almost exclusively in most tobacco counties for old land. In Vinton County, after stripping off the leaves in the field, hauling to tightly-constructed houses, and stringing on strings with a flat needle, and curing three days with furnace-heat, the stock is ready to take down and pack for market.

In Indiana, also, farm-yard manure is required for old ground, on which the largest crops are secured. In most tobacco-growing counties air-curing is practiced, first on scaffolds and then in houses. Hickory lands are in great request for tobacco. Very rarely are fertilizers used in Illinois, fresh lands being mainly employed, yet farm-manure is used somewhat upon fields long cultivated. Curing is done in open barns, or on scaffolds, and in houses.

Missouri tobacco is largely grown on fresh soil, land being plenty, and the culture given to this crop being an excellent preparation for wheat and other crops. If a fine quality of manufacturers' leaf is wanted, a thin soil is selected on oak and hickory uplands. If more than two crops are taken, inferior quantity and quality result. In rich soil, on pin-oak land, a dark, heavy article is grown. Fertilizers are scarcely ever used; on a small portion of the area, always in old ground, farm-manure is applied. Clover-sod is also cultivated profitably in tobacco. The old mode of curing is largely practiced; in some districts charcoal-curing has been introduced, with increase of price to the extent of 25 to 50 per cent. What is called the "Yankee plan" has been adopted by some—stringing the leaves with a needle and fastening the strings to the ends of the sticks.

MARKETING.

Some of our correspondents make note of the mode of packing and marketing. The crop of Litchfield County, Connecticut, was mainly bought, hanging on the poles, at 20 cents per pound. It is mostly delivered at the packing-houses of New Milford in bundles of 8 to 12 pounds, where it is sorted into four to six qualities, and packed in cases of 375 to 400 pounds each; and, during the months of May and June, undergoes a sweating, and becomes ready for market in August and Sep-

tember. Much of the last crop in Tolland County was sold before curing at about 35 cents. Little of the New York production was sold until February.

In Maryland, the stripping is done through the winter and spring; packing into hogsheads during spring and summer; and about one-half is usually sent to market as early as August. A portion of the finer qualities is used in this country, but most of the crop goes to Europe, where much of it is used for smoking. The Montgomery County packages vary from 500 to 1,000 pounds.

The fine tobacco of North Carolina is mostly taken to local manufactories in a loose state. The coarse grades are, in part, sent in the same manner, and a portion is packed in hogsheads, under pressure. The Warren County crop is packed in hogsheads of 1,200 pounds, and sold in Virginia, at Petersburgh and Richmond.

The Robertson County, Tennessee, crop goes mainly to Germany, France, Italy, and to Africa, except a small quantity of very fine dark wrappers taken by home manufacturers. In Barren County, Kentucky, after stripping, it is tied in bundles of twelve leaves each, and put into hogsheads holding about 1,500 pounds. In Christian, it is assorted generally into two classes, known as leaf and lugs, two-thirds to three-fourths being leaf and the remainder lugs, packed into hogsheads of 1,400 to 2,000 pounds, according to quality. In Simpson, most of the crop is sold in the hand to speculators. Most of the western tobacco is exported.

THE EXPORTATION.

The following table relative to the quantity and forms of the exportation of tobacco is compiled from the Treasury statistics of trade and navigation.

Years.	Leaf-tobacco.		Manufactured tobacco.		Cigars.		Snuff.	
	Pounds.	Dollars.	Pounds.	Dollars.	Thous.	Dollars.	Pounds.	Dollars.
1856	....	12, 221, 843	10, 008, 606	1, 809, 157	....	....	86, 055	20, 050
1857	....	20, 260, 772	7, 456, 666	1, 447, 027	....	....	50, 401	11, 526
1858	....	17, 009, 767	11, 210, 574	2, 400, 115	....	....	37, 245	10, 109
1859	....	21, 074, 038	14, 912, 811	3, 334, 401	....	....	239, 148	68, 090
1860	....	15, 906, 547	17, 697, 309	3, 372, 074	....	....	39, 923	11, 354
1861	....	13, 784, 710	14, 783, 363	2, 742, 828	....	....	81, 465	17, 703
1862	....	12, 325, 356	4, 071, 963	1, 068, 730	....	....	38, 839	7, 914
1863	....	19, 752, 076	7, 025, 248	3, 384, 544	....	....	44, 924	13, 633
1864	....	22, 845, 936	8, 586, 494	3, 603, 756	978	27, 314	28, 277	16, 813
1865	....	41, 592, 138	7, 294, 165	3, 439, 979	3, 713	140, 266	93, 159	39, 129
1866	190, 826, 248	29, 456, 145	6, 515, 709	1, 794, 689	7, 398	179, 746	18, 920	7, 981
1867	184, 803, 065	19, 640, 159	9, 681, 142	2, 795, 008	6, 104	144, 169	24, 342	12, 576
1868	206, 020, 504	22, 898, 823	10, 470, 024	3, 100, 084	1, 870	70, 350	11, 393	8, 730
1869	181, 527, 630	20, 552, 943	....	2, 759, 005	439	15, 519	31, 497	20, 252
1870	185, 748, 881	21, 100, 420	....	1, 592, 995	365	9, 584	20, 181	12, 226
1871	215, 667, 604	19, 908, 797	....	2, 022, 434	1, 433	53, 043	18, 724	11, 683
1872	234, 936, 892	24, 136, 166	....	2, 511, 866	197	6, 648	15, 092	5, 241
1873	213, 995, 176	22, 689, 135	....	2, 627, 585	215	7, 764	12, 196	7, 462
1874	318, 097, 804	30, 399, 181	....	2, 537, 782	2, 490	24, 473	15, 716	7, 092

Nearly all exported is in the form of leaf-tobacco, being taken largely by European governments which hold the tobacco-trade of their respective realms as a government monopoly, and restrict home cultivation, authorizing the growth of tobacco by special permits to a limited extent. The increase in this foreign demand has been marked for the past five years. The advanced price of the present crop may cause a reduction of the foreign shipments of the year, but there is a sufficient surplus of the crop of 1873 for all the demands of foreign trade.

WHEAT-DRILLING vs. BROADCASTING.

Among the current local and special investigations which the machinery of the statistical division makes peculiarly practicable, an attempt has been made to settle the question whether the drilling of wheat is followed by better results than broadcasting, and, if so in a majority of situations and circumstances, the degree of such resulting benefit. It seemed a question somewhat one-sided, yet there was no agreement as to the measure of the superiority of drilling, and there were those claiming to be good cultivators who offered proof of the greater profit of broadcasting. The causes of difference in opinion are clearly presented in this investigation—furnishing another proof that no agricultural rule is without exceptions, and none is invariable in results under all circumstances.

The use of the drill for winter-wheat has become so prevalent that many intelligent people think the practice of sowing broadcast by hand has become quite obsolete. It is by no means the case. Information acquired through our correspondence shows that of the entire winter-wheat area, 47 per cent. only is put in with the drill.

"*Does drilling tend to prevent winter-killing of wheat?*" Repeated testimony in the affirmative has been received from our correspondents which has commanded nearly universal acquiescence. Occasionally the negative has been assumed by writers for agricultural papers. In reviewing the deliberate utterances of our own correspondents, testimony has so accumulated as to settle the question beyond a peradventure.

Opinions are found to differ relative to the amount of benefit derived from drilling in different soils and seasons, but the general fact of advantage is affirmed by nearly all. The amount of advantage, expressed as a percentage, is estimated variously from 5 to 100 per cent. Calculated with reference to the quantity grown in each county, the average of all these estimates of increase is 10 per cent.

In the principal wheat-growing counties of New York the benefit is acknowledged freely. In Genesee 15 per cent. is deemed a low estimate of its advantage. In Onondaga drilling is regarded as "the only proper way to put in seed; a great protection against winter-frosts, and saves one-fifth of the seed." In Steuben and Wayne the crop is 50 per cent. better than that broadcasted; in Livingston and Ontario 10 per cent. "A better growth in the fall" is reported from Monroe. "In fourteen years' trial drilling proved a benefit in every year but one," says our Wyoming correspondent; similar statements coming from Erie and other prominent counties, and from many which have a smaller area in wheat. The majority in Niagara, a county which sometimes produces a million bushels, think drilling prevents winter-killing, though some prominent farmers do not admit it.

Testimony is in the same direction in New Jersey, with the sole exception of the return from Monmouth. In Burlington an exception is naturally enough made relative to marshy land, where winter-wheat could scarcely be expected to survive the effects of submerging and freezing. Of county reports from Pennsylvania, only three deny positively the winter protection of drilling, Lehigh, Clinton, and Union. In Lehigh it is said that wheat is worse killed where it is drilled. It is deemed an undecided question in Bucks, Chester, and Westmoreland. Drilling in Washington "prevents winter injuries to such an extent that portions of fields drilled last fall for testing this question produced fair crops, while portions broadcasted failed entirely." "A larger straw, better

berry, and larger yield," are results of drilling in Luzerne. It is acknowledged in Delaware that it saves seed, yet some farmers still doubt the economy of drill-culture. In Snyder, last season, "nearly all the broadcast sowing was frozen out, while that drilled had deeper root and did much better." Our Wyoming correspondent "in fifteen years' experience, on a farm of 250 acres, never lost an acre of drilled wheat." Maryland reports indicate the superiority of drilled crops without a positive exception. Those from Virginia maintain a similar unanimity. The King George correspondent declares drilled wheat the best "from the coming up to the reaping." In Nelson "drilled wheat is held to be proof against winter-killing if put in early," and even if late, is better than broadcast. A greater advantage on clay than on sandy soils is indicated in several localities.

In the cotton States drills are almost unknown. A few have been introduced into Texas, and in parts of Tennessee they are more numerous and deemed a decided advantage. In West Virginia and Kentucky, wherever used, they are credited with enhancing the supply of wheat.

Without exception the reports from Ohio acknowledge the benefit of the drill; in Williams only the qualification is added, "some doubt it." In Hardin a nearly double product is claimed; in Morrow "recent results of drilling have been more efficacious than ever before known;" in Highland it is found more beneficial in connection with deep plowing; in Hancock the recent product of drilled wheat ranges from 20 to 47 bushels per acre. The Logan correspondent says: "There are exceptional seasons, in which broadcast wheat does not winter-kill to any appreciable extent, but I should estimate that, on an average, drilled wheat will have the advantage of broadcast in withstanding the winter siege to the amount of 20 per cent. of the crop. Reasons: It is more uniformly placed at a depth that enables it to anchor its roots deep in the soil; and the ridges that the drilling leaves on each side of the wheat-bed are, by degrees, precipitated on the young plants by the same alternate freezing and thawing that lifts the wheat, thus making use of the same means, at the same time, to counteract its injurious influence." A correspondent in Michigan, representing Livingston, says: "It does not prevent winter-killing, but rather increases it, the land being very flat, the furrows holding the melted snow." All other counties report a belief in drill-culture as a preventive of winter-killing. Its superiority in seasons of autumn drought is repeatedly claimed. Throughout Indiana the testimony is the same. Laporte alone says "No," but adds that the soil is sandy, and that wheat, either drilled or broadcast, escapes winter injuries. In one county, Perry, not a wheat-drill is found, but they are used very generally throughout the State. It is said in Franklin: "None but old fogies sow broadcast here, and they are scarce. No fact in agriculture is better established than that drilling grain is a great improvement on broadcasting." The drill is credited in Ripley with an increase of 4 or 5 bushels per acre; in Jasper, with 5 bushels on low land, and 2 on high ground. Of thirty-two counties reporting relative to winter-wheat in Illinois, there is not a positive dissent to the theory that drilling is a winter protection. The benefit in dry seasons is emphatically asserted, and attributed to the deeper planting and the pulverization of the seed-bed by the drill. In Macoupin drilled wheat is assumed to be a sure crop, while that sown broadcast will winter-kill to some extent every winter, and probably entirely one winter in every three. In Clay County the advantage is stated at 15 per cent., though it is admitted that no benefit is received on certain clay soils that become early saturated and "run

level." It is admitted in Lawrence that wheat, often a good crop when drilled, is a failure when broadcasted. In Washington "broadcasting never yields half a crop," and is abandoned. In Richland "many decline to plant wheat unless it is drilled," and it is stated that the crop has been doubled since the drill was introduced. The Schuyler correspondent reports an experiment in which three acres drilled yielded 18 bushels per acre, while seven acres broadcasted were not worth harvesting.

In Wisconsin, Minnesota, and Iowa, there is no winter-wheat grown worth considering. The general belief in the liability to winter injury, whatever the mode of planting, is strong. In some counties of these States there is a small portion of winter-wheat sown, and in several of these the advantage of drilling is conceded. In Lee, Iowa, which produced 95,326 bushels of winter-wheat in the census year, it is said that "last winter the drilled wheat stood the winter well and produced a good crop, while that sown broadcast was so much winter-killed as hardly to pay the expenses of harvesting."

In Missouri, returns cover forty-seven counties, of which only one (Platte) reports drilled wheat as unreliable as broadcast. In Benton "the only way to secure a crop" is by the use of the drill. In Chariton it insures almost certainly a full yield, while broadcast wheat is often but half a crop; and in certain soils in Franklin it doubles the yield. "Drilled wheat is scarcely injured; broadcast wheat is half winter-killed," says the correspondent in Greene. In Marion "last winter a marked difference appeared. Nearly every crop of broadcast proved a failure, while many crops of drilled yielded 20 to 25 bushels per acre; generally a difference of 30 per cent. in favor of drilling." In La Fayette, "during the last season, all drilled wheat made fair returns, while at least 50 per cent. of broadcast did not make a fourth of a crop." In Stone the advantage is placed at 33 per cent. if the drills run north and south. The explanation is, "when the drills run north and south, the sun at noon strikes the furrows on each side, thawing the frozen sides, and the dirt falls in and keeps the roots covered."

The verdict of Kansas is decidedly in favor of the drill. Very few counties give opposing testimony. Marion objects. Dickinson says, "All wheat winter-killed last winter;" and Lincoln reports "drilled wheat winter-killed worse than broadcast." Droughts in autumn, which are not unfrequent, are less injurious to wheat where the drill is used. From Nemaha the report is, "Five per cent. of drilled wheat is killed; 30 per cent. of the broadcast." In Cherokee "great destruction of broadcast; 15 per cent. of the drilled." In Coffey 50 per cent. of the acreage is drilled and 95 per cent. of the product. In Montgomery "nearly all the broadcast is killed." In Shawnee the preference is expressed for drills running east and west, because the prevailing winds are north and south, and the injury from displacement of earth is less. A farmer in Jefferson says he once put in 80 acres of winter-wheat, and "got 27.73 bushels to the acre." His neighbors sowed broadcast, and "not one had good wheat." He says he has "raised four crops in succession without winter-killing," while his neighbors have had their crops "frozen out."

Drills are not much used in Nebraska, and scarcely at all among the mountains or on the Pacific coast.

The following table gives the number of counties reporting; the proportionate area represented compared with the entire winter-wheat area of each State; the proportion of this area sown and drilled, respectively; the estimated increase of product by drilling over that obtained

by sowing; and the estimated quantity of seed used per acre, respectively, in these modes of seeding:

States.	Area represented.		Proportion sown.	Proportion drilled.	Increase of product by drilling.	Seed per acre.	
	No. of counties.	Percentage.	Percentage.			Bushels in broadcasting.	Bushels in drilling.
New York	21	63	50	50	13	1.80	1.60
New Jersey	10	22	45	55	6	1.95	1.60
Pennsylvania	33	62	30	70	12	1.74	1.49
Delaware	2	43	26	74	10	1.75	1.50
Maryland	8	66	24	76	7	1.70	1.43
Virginia	29	35	62	38	12	1.44	1.21
North Carolina	18	26	97	3	......	1.07	.83
South Carolina	4	......	99	1	......	1.00	.70
Georgia	16	14	99	1	......	1.00	.90
Alabama	8	......	99	1	......	1.00	......
Mississippi	5	......	99	1	......	1.25	......
Texas	9	21	98	2	......	1.18	.90
Arkansas	2	......	100	......	......	1.10	......
Tennessee	27	37	96	4	10	1.20	1.10
West Virginia	17	57	58	42	12	1.53	1.33
Kentucky	23	22	92	8	10	1.36	1.11
Ohio	38	51	39	61	16	1.57	1.33
Michigan	22	52	49	51	9	1.62	1.40
Illinois	32	39	24	76	19	1.52	1.24
Indiana	41	44	49	51	15	1.48	1.21
Missouri	47	45	62	38	21	1.52	1.21
Kansas	23	36	55	45	16	1.49	1.23
Nebraska	2	4	51	49	17	1.56	1.25
California	9	......	98	2	......	1.33	......
Oregon	7	21	81	19	5	1.50	1.21

The proportion of spring-wheat sown is about 40 per cent. of the whole crop. It is grown mainly in Wisconsin, Minnesota, and Iowa, almost to the exclusion of fall-sown wheat in those States. Michigan, though as far north as either, produces almost exclusively winter-wheat, owing to the modifying influences of the surrounding waters, and perhaps in some degree to the soil, much of which has good natural drainage. One-third of the crop of Illinois (in the northern counties) is spring-wheat. A small portion of that of Kansas is sown in the spring, and nearly all of that of Nebraska. California is anomalous in wheat as in everything else. Wheat can be sown all through the summer to sprout when rains fall, or it may be put in all through the rainy season till spring. In point of fact, the planting season has actually a range of several months. The little grown in the New England States is nearly all spring-wheat. In the Middle and Southern States, and in the Western States not named above, fall-sowing is almost the exclusive practice. A little is sown in the spring in New York and Pennsylvania.

A considerable portion of the farmers of New England, including some of our correspondents, have never even seen a drill. One report from Vermont (Grand Isle) makes the yield of drilled double one year, while the next showed little difference. In Aroostook, Maine, new land often yields 20 bushels per acre with broadcast sowing.

The use of the drill is nowhere the predominant practice in the spring-wheat region. Our returns cover nearly one-half of the area of spring-wheat, and the proportion reported drilled is found to be 39 per cent. in Minnesota, 38 in Wisconsin, 21 in Iowa, 11 in Illinois, 49 in Kansas, and 7 in Nebraska. The average proportion of spring-wheat drilled

throughout the country is 30 per cent. A still larger proportion is seeded by the use of some style of broadcast-seeding-machine, leaving the remainder to be sown by hand, mostly in lands having stumpy or uneven surfaces, where fields are small, or where new farms have been opened, and cultivation attempted before the pioneer could find means to procure drills or seeders. A very small proportion is actually seeded by hand, far less than in the cultivation of winter-wheat.

In the Eastern States, to a considerable extent in the Middle States, almost exclusively in the Southern States, and in the region south of the Ohio, hand-sowing is practiced; and when a machine is used in putting in winter-wheat, it is generally a drill, very rarely a broadcast-seeder.

Various forms of broadcast-seeders, which are a great improvement on broadcast sowing by hand, are used in the West. They have come in since drills, and for spring sowing have displaced them in many localities. A principal reason assigned for this preference, especially in corn-growing Illinois, is their better adaptation to sowing after corn, without plowing, which is a prevalent practice. It is slovenly but cheap, and a scarcity of farm-labor compels its adoption by the average farmer. Our Kankakee correspondent says that "farmers who drill winter-wheat broadcast their spring crop, and declare that corn-land harrowed in grows less to straw and is less liable to fall down."

There is another ground of opposition to the drill, which is a direct confession of slovenly farming. It is very common in the whole Northwest, and appears to constitute a very prominent objection. It is that the drill leaves between the rows wide spaces "in the best possible condition for the growth of every kind of weed." In the case of the corn-land, the mellow row-spaces are already full of weeds at the time of planting, and their presence and future growth are the result of the absence of all preparatory culture, with which the drill has no connection whatever. As the drill alone, running among grass and weeds, over corn-hills, was found to be impracticable, a compromise was made between negligence and labor, and a cultivator and broadcast-seeder were combined to accomplish the least amount of work admissible at the lowest cost; and as this sort of culture is the rule in the spring-wheat region, the seeder largely predominates, the drill being used only in sections where more thorough culture prevails. It is admitted generally, throughout this region, that in dry soils the drilled wheat, which is put in at a uniform and greater depth, gives more satisfactory results. In Dane County, Wisconsin, it is declared that "drilling does as well always, and in dry seasons better." If a dry, sandy field is late sown, it should be drilled, says the Pierce County correspondent. In Saint Croix it is affirmed that "in dry ground, or when dry weather follows, drilled wheat produces four or five bushels more per acre." In Fillmore, Minnesota, a great wheat-growing county, our correspondent asserts, from an experience of fourteen years, that "drilling produces three to five bushels more per acre, with one-eighth to one-fourth less seed." In Olmsted it is thought "drilling is not superior to broadcasting, except in dry seasons." Our Houston correspondent prefers a mixed practice, deeming it "a good plan to drill both ways, one way east and west, that the weeds may be more shaded, and then cross-drag to scatter some of the grain." In Nicollet the drill "is best if fields are kept clean." In Freeborn the seeder "is most used, worked among grubs, stones, and in wet land, but the drill is best in dry soil." Similar views are reported throughout Iowa. Four-fifths of the area is sown broadcast. It is universally believed that the seeder is better than hand-sowing. Some prefer plowing in. For dry soils preference is expressed here, as else-

where, for the drill. Our correspondent in Jasper, from a long experience, gives 10 per cent. preference to the drill. In Tama the seeder is used, but fall plowing of corn-land gives better results than spring plowing. In Marion, "drilled wheat has stouter growth of stem; it tillers better, the roots reaching moisture." Our Hancock observer thinks he could grow winter-wheat with drill-culture. In Leavenworth, Kansas, the reporter thinks the practice of drilling promotes better culture, as the ground must be in good order to use the drill advantageously. The importance of drilling, as a preventive of the effects of drought, are enforced repeatedly by Kansas correspondents. The light soils of Nebraska are deemed well suited to drill-culture. The following extracts illustrate some of the main points in seeding:

Mercer, Ill.—Owing to the fact that nearly all our spring-wheat is sown upon ground previously occupied by corn, and upon which a drill could not work, the crop is sown broadcast. Many drills were introduced and thoroughly tried several years since. All are now thrown aside to rot in fence-corners. I have known but one piece to be drilled in fifteen years, and the party doing it has not repeated the experiment. It is so seldom that they can be used, either for profit or convenience, that it does not pay to keep the machine. The time may be approaching when we shall adopt summer fallowing, and with it the drill; but while we have the cattle of the West to stall-feed, we shall raise wheat, only to prepare our ground for grass.

Steel, Minn.—Formerly all spring-wheat was sown broadcast. The best farmers now have changed to a great degree their practice. If the ground is in good working condition and clean, there is a general concurrence that drilling is best. Some use a broadcast machine, because they can hurry in the early spring, and put the grain in before the ground is dry, even before the frost is out but a few inches. The only other objection to drilling that is much urged is that it gives the weeds a much better chance to start and grow between the drills of 6 inches than if the seed be evenly scattered. This, it is acknowledged, is only occasionally the case, as in the season of 1871, when there was a hot, dry time in May and June, and even then weeds were perhaps as vigorous and numerous in the broadcast sowing. These are the objections I hear urged, but the opinion is prevalent that these statements are at least but partially true, and that the deeper covering of the seed and the less seed necessary are both positive advantages; and, further, the great test, that drilled seed, on the whole, produces the best crop. Some farmers think that the drills only 4 instead of 6 inches apart would give better results.

Hardin, Iowa.—I have followed both drills and broadcast seeders over hundreds of acres for the sole purpose of observing which did the best work. I find that when the soil is just right as to moisture, the drill covers best, hardly a dozen grains remaining uncovered to a square rod; but if the soil is rather wet it *will not fall back* properly so as to entirely cover the seed deposited in the bottom of the furrow, and if the ground is foul with roots, weeds, or stubble, poorly turned under, and rather too wet, the points of the drill-teeth clog badly. Most good farmers will say you must not sow your seed when the soil is too wet; which is very true in most soils, especially clay or clayey; but every one hereabouts who has tried it has found that when the time comes for sowing, the condition of the soil as to moisture, at least as to being too wet, is of little consequence; so that *time* seems to be the "essence of the contract" more than condition of soil. I first observed this in 1867. I went twice across a field with a broadcast seeding-machine, making a strip one rod wide, or just half an acre. The ground was so wet that the horses sunk to their fetlocks at every step, and seemingly one-fourth of the grain remained uncovered, as the soil worked up by the seeder-teeth appeared more in the condition of mortar than like a proper seed-bed. So I quit for two days, until the sun and wind had dried out the land properly, when I resumed work with the same machine, same seed, and same rate of seed per acre, and finished the field of forty acres in the same way. None of the land was harrowed after the sowing. The strip first sown came up first, looked better, and kept ahead all through the season, showing a plain difference at a distance of one hundred rods, so much so as to attract the attention of almost every one who passed. Thinking that I had discovered something, I harvested the first-sown strip separate, and another strip of the same size also separate. The result was, the first-sown strip, half an acre, yielded eleven bushels, and the other strip nine bushels. Another farmer, living about three miles from me, made the same discovery the same season; and every one who has tried the plan, to "put in their wheat in time," as they call it, without reference to the condition of the soil, even when hardly thawed enough to cover the seed, has confirmed the wisdom of the practice.

Labette, Kansas.—We have harvested but six crops from our broad, unfenced fields of

this county. The first four were sown all broadcast. The ground was then very rough and the country new, and no machinery of any kind was used in sowing or harvesting. From the roughness of the ground, which was somewhat of a shelter to the crop, the stand was generally good. In our fifth crop—the sod was by this time all rotten and the ground very smooth and level—we found that by sowing it broadcast, our process of "dragging" it in did not bury the seed deep enough, and that our violent northern winds blew what little dirt there was from around the roots of the wheat, and in many instances blew the plants entirely out of the ground or left them merely hanging by one or two roots, from which but a poor stalk or head could ever be harvested; hence our crop of 1871 was a failure in many places. In sowing our sixth crop, many conceived the idea of deep drilling, and from actual observation and experience the following facts are evident: Wheat that is drilled deep, east and west, and not rolled after, is equivalent to the planting of it in small trenches and deep enough in the ground to draw plenty of moisture; and as our strong winds are either from the north or south, they will in this case pass directly over the drills of wheat in the trenches without doing any injury whatever, as the roots are so deep in the ground as to be below the force of the winds, and the dirt on the sides is blown into the trenches, thus planting the roots deeper into the ground and saving it from the frosts that winter-kill our wheat. The trenches that the drills make also answer admirably for surface-drainage, in connection with some main furrows that should be opened, north and south, with the plow, and cleaned up with the shovel. This county intends in the coming wheat-crop to test fully the efficiency of drilling over broadcast sowing. Of the last crop, nine-tenths was drilled. *Nemaha:* The advantages of drilling spring-wheat over broadcast sowing are so evident here that no farmer who can get the use of a drill will have his wheat put in otherwise. The same is true of other grains. About the time of spring-seeding here there is much windy weather, and the most expert hands fail to distribute the seed evenly over the ground, the grain coming up in thick and thin streaks. The thick will ripen first and produce an inferior quality of grain, while the weeds will grow in the thin places. The uneven depths of covering of broadcast-sown grain is a great disadvantage to the crop, causing it to grow and mature unevenly, while some drills leave the surface of the ground smoother and in a better condition for the harrow. In 1858, when this county first began to settle up, many of the best farmers tried spring-wheat broadcast, for several years, with but partial success. Some were nearly discouraged, but, having procured drills, the same men have become the most successful wheat-growers in the country, and annually market hundreds of bushels of the finest wheat. A gentleman in this town (a good farmer) for several years tried to raise spring-wheat and other grain by broadcast sowing, only partially succeeding; he finally concluded it was not a good country for wheat, and sold his farm. The purchaser uses the drill, and succeeds every year on the same ground where the other failed. The use of the drill is an advance step in the progress of agriculture. No country is better adapted to its use than the prairies, and the time is near when it will be as indispensable to the well-ordered farm as the wagon.

SUMMARY.—The following conclusions are presented:

1. Forty-seven per cent. of the winter-wheat and thirty per cent. of the spring-wheat, or about thirty-seven per cent. of the aggregate of both kinds, represent the proportion seeded with a drill.

2. Nine-tenths of the testimony given asserts the superiority of the drill for winter-wheat.

3. An average increase of one-tenth in the yield is assured by the use of the drill.

4. A large majority of observers declare that, in most soils in which injury resulting from frost is liable to occur, drilling prevents or reduces the loss.

5. The majority assert that in certain clay soils with rolling surfaces some advantage accrues in surface-drainage by the use of the drill; while in some heavy soils with flat surfaces the water freezing in the drill-furrow does positive injury.

6. The broadcast seeder predominates in spring-wheat regions, because better adapted than the drill to seeding in unplowed corn-fields, on rough surfaces, and in weedy fields.

7. About one-sixth of the seed-wheat (or 5,000,000 bushels for the crop) might be saved by the exclusive use of the drill. The average quantity of seed used per acre in seeding winter-wheat is 1.35 bushels; 1.24 bushels for the drilled; 1.44 for the sown.

8. The drill is used for seeding in connection with thorough culture, especially in winter-wheat growing; the broadcast seeder for imperfect culture and rough surfaces; and sowing by hand is the method adopted for small patches and first efforts of impecunious pioneers.

PUBLIC LANDS OF THE UNITED STATES.

The term public domain, in its widest and most common application, includes the entire area of which the Government has at any time held the title to the soil. This title was derived from two sources: First, different States in the Union ceded to the General Government the lands claimed by them under their original colonial charters from the British Crown; secondly, vast unoccupied territories were acquired from foreign powers by treaty. It has ever been the policy of the Government to transfer its title to private owners as rapidly as possible. A systematic survey of the lands, being an essential prerequisite to the transfer of title, was the first care of the Continental Congress on receiving the first cession from Virginia of the territory north of the Ohio River. The system adopted was a rectangular subdivision of the soil into townships, sections, and minor subdivisions by means of geographical parallels and meridians. Each township, six miles square, embraces thirty-six sections, each consisting of a square mile, which in turn is subdivided into sixteen quarter-quarter-sections, the smallest legal subdivisions known. The records of the surveying branch of the public-land service are very complete and full, rendering it possible to state the exact amount of land surveyed and the amount still unsurveyed at the close of each fiscal year. According to the late report of the Commissioner of the General Land-Office, the area surveyed and the area unsurveyed at the close of the fiscal year ending June 30, 1874, were as follows:

Public land States and Territories.	Area of public lands.		Area surveyed up to June 30, 1874.	Area remaining unsurveyed June 30, 1874.
	Square miles.	*Acres.*	*Acres.*	*Acres.*
Ohio	39, 964	25, 576, 960	25, 576, 960	....
Indiana	33, 809	21, 637, 760	21, 637, 760	....
Illinois	55, 410	35, 462, 400	35, 462, 400	....
Michigan	56, 451	36, 128, 640	36, 128, 640	....
Wisconsin	53, 924	34, 511, 360	34, 511, 360	....
Alabama	50, 722	34, 462, 080	34, 462, 080	....
Mississippi	47, 156	30, 179, 840	30, 179, 840	....
Louisiana	41, 346	26, 461, 440	23, 909, 253	2, 558, 187
Florida	59, 268	37, 931, 520	29, 345, 870	8, 585, 650
Missouri	65, 350	41, 824, 000	41, 824, 000	....
Arkansas	52, 198	33, 406, 720	33, 406, 720	....
Iowa	55, 045	35, 228, 800	35, 228, 800	....
Minnesota	83, 531	53, 459, 840	35, 897, 912	17, 561, 928
Kansas	81, 318	52, 043, 520	45, 770, 685	6, 272, 835
Nebraska	75, 995	48, 636, 800	32, 372, 410	16, 264, 390
California	188, 981	120, 947, 840	38, 805, 776	82, 142, 064
Oregon	95, 274	60, 975, 360	15, 255, 617	45, 719, 743
Nevada	112, 090	71, 737, 600	8, 198, 194	62, 839, 547
Washington	69, 994	44, 796, 160	10, 190, 046	34, 606, 114
New Mexico	121, 201	77, 568, 640	5, 486, 185	72, 082, 455
Utah	84, 476	54, 065, 043	5, 984, 792	48, 080, 283
Dakota	150, 932	96, 596, 128	13, 863, 913	82, 731, 927
Colorado	104, 500	66, 880, 000	15, 683, 086	51, 196, 914
Montana	143, 776	92, 016, 640	6, 784, 481	85, 232, 159
Arizona	113, 916	72, 906, 240	3, 135, 753	69, 770, 551
Idaho	86, 294	55, 228, 160	4, 014, 953	51, 213, 207
Wyoming	97, 883	62, 645, 068	4, 748, 841	57, 896, 279
Indian	68, 991	44, 154, 240	22, 832, 725	21, 321, 515
Alaska	577, 390	369, 529, 600	....	369, 529, 600
Total	2, 867, 185	1, 834, 998, 400	649, 393, 052	1, 185, 605, 348

From the foregoing table it appears that all the lands ceded by the States to the General Government, and lying within the original limits of the Republic, as defined by the treaty of peace with Great Britain in 1783, have been surveyed. Of the foreign acquisitions east of the Mississippi River, less than nine million acres remain unsurveyed, including eight and a half millions in Florida, and a small number in Louisiana. West of the Mississippi the public surveys have been completed in Missouri, Arkansas, and Iowa. In Louisiana the servey is nearly complete, and is approaching completion in Kansas. One-third of the entire area has been surveyed. Of the remainder, including Alaska, it is probable that about five hundred million acres will never be surveyed, on account of their unfitness for agricultural cultivation of any kind. Nearly one-half of the public domain available for occupancy has been surveyed.

For the disposal of the public lands Congress has provided several methods by sale or donation. The records of this branch of the service failed from the beginning to show the progress and extent of this transfer. Several years ago an effort was made to ascertain the extent to which the Government had parted with its title to the public land, but the results were so unsatisfactory that the General Land-Office, after 1871, ceased to publish among its statistics the amount of land undisposed of and awaiting disposal. According to the statement in the annual report for the fiscal year ending June 30, 1871, there were 1,376,529,562 acres remaining unsold and unappropriated. This can be regarded only as an approximate estimate. During the three subsequent years the aggregate area sold or otherwise disposed of amounted to 34,426,455 acres, which being deducted from the previous aggregate, leaves 1,342,093,107 acres as the approximate area of public lands not disposed of July 1, 1874.

In Ohio, Indiana, and Illinois there remain only a few tracts of refuse land scattered through the States. In Missouri there are about 100,000 acres; in Iowa about a million; in Michigan about three millions; in Mississippi about four and a half millions; in Alabama, five and three-quarter millions; in Louisiana, six millions; in Wisconsin, seven millions; in Florida, seventeen millions; in Arkansas, ten millions. In the States and Territories west of the Mississippi a smaller proportion of the lands have been sold, leaving immense areas open to appropriation. In Alaska it was estimated by a former Commissioner of the General Land-Office that about 20,000 square miles or 12,800,000 acres, equal to half the surface of Ohio, are capable of some sort of culture. The rest of that immense region, according to our present information, seems totally unfit for agricultural settlement. In regard to the regions west of the Mississippi, it would be rash to assign any limit of profitable cultivation and settlement. The successful treatment of some very unpromising regions by irrigation has exploded some dogmatic theories on this subject founded upon imperfect information. If we add to the unappropriated public lands the large areas still unsettled that have passed into the hands of railroad and other corporations and of private speculators, it is not at all improbable that we still have a body of land suitable for settlement about double the original area of the republic at the close of the Revolution.

The appropriation of public lands during the fiscal year 1874 amounted to nine and a half million acres, a decrease of three and a half millions compared with 1873. The falling off was mostly in lands certified to railroad corporations, in swamp selections, and in lands granted to schools, agricultural colleges, and universities. The certificates to rail-

road companies alone show a decrease of 2,819,222 acres. A new class of entries under the timber-culture act amounts to four times the decrease in homestead entries. The appropriation of public lands by actual settlers during the past year shows an increase of half a million acres in spite of the decline of immigration and the financial stringency of the past eighteen months. It is probable, however, that the full force of these restrictive causes will be more fully shown in the current and future fiscal years, as the disposals of the last year represent claims inaugurated under a stronger pressure of westward migration than now subsists.

In acquiring title to the public lands, it is necessary to take into consideration several important technical distinctions that have grown up under the laws regulating their disposal. In the first place, lands are classed as surveyed and unsurveyed. Land is technically unsurveyed until the official plat of survey of each township, after approval by the General Land-Office, has been received at the local office. Only inceptive rights can attach to unsurveyed land, as in the case of railroad grants, many of which, having been made prior to survey, could only designate specific sections that were to accrue to the beneficiary after their location by legal landmarks upon the soil. Pre-emption settlers, who have located upon unsurveyed lands, are allowed three months after the receipt of the official plat of survey at the local office within which to inaugurate a legal record of their claims. In no other way is the public domain open to appropriation by private parties.

After survey, at the discretion of the Government, lands are offered for public sale by auction after due notice. Prior to this they are designated as *unoffered* land. If, after the day appointed for public sale, they remain undisposed of, they are called *offered* lands. They may by law be either reserved from sale or entirely withdrawn from the market.

Lands are also distinguished as minimum and double minimum lands. Minimum lands are appropriable at the price of $1.25 per acre. Double minimum lands are held at $2.50 per acre. They consist of the alternate sections lying within the limits of railroad grants, but reserved from the operation of those grants. Their price is doubled on the ground of their enhanced value from their proximity to railway communication.

Offered lands may be acquired at any time by a process known as *private entry* or *location*. The purchaser designates in writing, by legal subdivisions, the tract he desires to purchase, in an application filed with the register of the local land-office of the district within which the lands lie. The register then certifies this application to the receiver, who issues a duplicate receipt for the purchase-money, one copy being given to the purchaser and the other forwarded, with the register's certificate, to the General Land-Office. If there be no conflicting claim, the land is conveyed to the applicant by letters-patent from the United States. Instead of paying cash the purchaser may locate upon the land a military bounty-land warrant, or some other piece of land-scrip, duly assigned. In case of double minimum land, the locator must pay $1.25 per acre in addition to the location of the warrant.

Unoffered land can be taken only under the pre-emption, homestead, or timber-culture acts. The personal qualifications for an applicant under each law are the same. He must be twenty-one years old, a single man or head of a family, and a citizen of the United States, or a foreigner who has, in a proper court, declared his intention of becoming a citizen. Under the pre-emption law the applicant must

also show that he is not the owner of 320 acres of land and that he has not previously enjoyed the pre-emption privileges. His first notice of appropriation of the land is actual settlement, followed by continued residence, cultivation, and substantial improvement of such a character as to indicate an intention, *bona fide*, to make the land his permanent home. He cannot embrace more than 160 acres in his claim. If the tract is *offered* land, he must, within thirty days after settlement, appear before the register and receiver and file a declaratory statement, setting forth his legal qualifications, his intention to make the land his permanent home, and that the settlement and appropriation is for his own exclusive benefit. Within twelve months from settlement he must again appear before the register and receiver, make satisfactory proof of compliance with the law, and pay for the land in cash or by the location of a land-warrant or other land-scrip. If the land is *unoffered*, the settler is allowed three months from settlement for the filing of his declaratory statement and twenty-one months to prove title and pay for the land. In the case of unsurveyed land, he must file within three months after the receipt of the plat of survey of the township at the local land-office, and within eighteen months thereafter must prove title and pay for the land. A failure to meet these requirements works a forfeiture of pre-emption rights and a loss of the improvements placed on the land. Should the settler die before completing the steps necessary to be taken, his legal representatives may perfect the claim and take out a patent in the name of his legal heirs. By decision of the Commissioner of the General Land-Office, women have the same rights as men under the pre-emption laws.

The homestead-settler initiates his claim by a formal application, designating the tract he desires to appropriate by its legal subdivisions. Hence he cannot appropriate unsurveyed land. He must at the same time file an affidavit, setting forth his legal qualifications and his intention to comply with the homestead-law. He must then make settlement without delay upon the tract, not exceeding 160 acres of minimum or 80 acres of double minimum land. After five years of continued residence, cultivation, and improvement, he appears before the register and receiver and makes proof of compliance with the law. He may delay his final proof two years longer. If the fees required by law have been paid, the land is patented.

The timber-culture act of March 13, 1874, does not require settlement, but planting with trees one-fourth of the tract desired, never exceeding 160 acres, and keeping it in cultivation for eight years. The applicant must file his written application with his affidavit, showing his legal qualifications, and that the land is exclusively prairie and devoid of timber. He must, within one year from his application, break up one fourth of the required timber-area, another fourth within two years, and the remaining half within three years. One fourth must be planted the second year, another fourth the third year, and the remaining half the fourth year. The trees must not be more than 12 feet apart, and protected and cultivated till the close of the eighth year from his application, when, by filing a second affidavit, showing his compliance with the law and producing satisfactory proof of the fact, he is entitled to a patent.

The above provisions of law evince an earnest purpose on the part of the Government to dispose of its landed interest to private parties as fast as their interests and those of the community demand. By liberalizing as above the terms of individual appropriation, and by withholding lands from public sale until settlers, under the pre-emption and homestead laws, have secured the choice locations, speculative

land monopoly has been baffled, and by far the greater portion of the soil already disposed of has passed into the hands of actual cultivators.

But the public domain has also been disposed of for the purpose of advancing several collateral interests of civilization. About 75,000,000 acres have been granted to soldiers of the Republic in various ways. The military-bounty acts, dating from 1847, gave away 550,182 warrants, covering 60,873,350 acres, of which only 25,912 warrants, embracing 1,970,620 acres, are outstanding. Many of the latter, from improper assignment, have become wholly worthless. In aid of educational establishments of all kinds more than 90,000,000 acres have been granted. Under laws granting swamp-lands to the States within which they are located, selections have been made to the extent of 62,906,984.56 acres, of which 40,378,727.29 have been patented. In aid of canal-construction 4,405,986 acres have been granted to different States. The grants for wagon-roads amounted to 2,412,543.63 acres. In aid of railroad-construction the enormous area of 215,203,807.97 acres has been granted to States or corporations, of which, however, only 38,076,290.40 acres have been patented. A portion of these grants has already lapsed, and other portions will also fail through non-compliance with the terms upon which they were made.

AGRICULTURAL EXPORTS.

Statement of the exports of agricultural products of the United States, with their immediate manufactures, for the two years ending June 30, 1874, collected from the reports of the Bureau of Statistics of the Treasury.

	1873.		1874.	
	Quantity.	Value.	Quantity.	Value.
Animals, living:				
Hogs ....No.	99, 790	$787, 402	158, 581	$1, 625, 837
Horned cattle ....do..	35, 455	695, 957	56, 067	1, 150, 857
Horses ....do..	2, 814	255, 365	1, 432	169, 303
Mules ....do..	1, 659	172, 172	1, 252	174, 125
Sheep ....do..	66, 717	107, 698	124, 248	159, 735
All other, and fowls	....	14, 853	....	30, 531
Animal matter:				
Bone-black, ivory-black, &c ....lbs.	1, 392, 150	39, 307	903, 823	58, 121
Bones and bone-dust ....cwt.	100, 185	167, 135	47, 868	108, 440
Candles ....lbs.	1, 998, 557	301, 202	1, 995, 092	302, 277
Furs and fur-skins	....	3, 725, 550	....	3, 334, 365
Glue ....lbs.	42, 556	8, 754	71, 564	12, 939
Hair, unmanufactured	....	334, 663	....	394, 056
Manufactures of hair	....	48, 795	....	33, 257
Hides and skins other than fur	....	3, 605, 023	....	2, 560, 388
Leather of all kinds not specified ....lbs.	17, 241, 746	4, 365, 174	15, 628, 285	3, 940, 450
Morocco and other fine	....	247, 711	....	232, 884
Boots and shoes ....pairs.	260, 759	421, 548	243, 500	383, 417
Saddlery and harness	....	101, 943	....	98, 132
Other manufactures	....	169, 118	....	131, 635
Oil, lard ....gals.	388, 836	298, 731	252, 577	203, 317
Other animal ....do..	10, 984	9, 237	17, 090	17, 285
Provisions:				
Bacon and hams ....lbs.	395, 381, 737	35, 022, 137	347, 405, 405	33, 383, 908
Beef ....do..	31, 605, 196	2, 447, 481	36, 036, 537	2, 956, 676
Butter ....do..	4, 518, 844	952, 919	4, 367, 983	1, 092, 381
Cheese ....do..	80, 366, 540	10, 498, 010	90, 611, 077	11, 898, 995
Condensed milk	....	94, 385	....	79, 018
Eggs ....doz.	15, 683	4, 169	23, 749	5, 239
Lard ....lbs.	230, 534, 207	21, 245, 815	204, 527, 471	19, 308, 019
Pork ....do..	64, 147, 461	5, 007, 035	70, 482, 379	5, 808, 712
Preserved meats	....	575, 407	....	848, 246
Soaps, perfumed and toilet	....	10, 561	....	8, 460
All other ....lbs	9, 441, 891	657, 297	9, 345, 358	651, 282
Tallow ....do..	79, 170, 558	7, 068, 471	101, 755, 631	8, 135, 320
Wax ....do..	374, 486	118, 053	342, 068	113, 800
Wool, raw and fleece ....do..	75, 129	17, 624	319, 600	72, 169
Manufactures of ....do..	....	209, 897	....	124, 099
Total value of animals and animal matter	....	99, 806, 599	....	99, 607, 669

Statement of the exports of agricultural products of the United States, &c.—Continued.

	1873.		1874.	
	Quantity.	Value.	Quantity.	Value.
Breadstuffs and their preparations:				
Barley ... bush.	482,410	$323,187	330,399	$210,738
Bread and biscuit ... lbs.	11,700,767	690,832	11,142,439	676,197
Corn ... bush.	38,541,930	23,794,694	34,434,606	24,769,951
Corn-meal ... bbls.	403,111	1,474,827	387,807	1,529,399
Oats ... bush.	714,072	290,575	812,873	383,762
Rye ... do..	562,021	469,547	1,564,484	1,568,362
Rye-flour ... bbls.	8,288	46,129	59,820	388,313
Wheat ... bush.	39,204,285	51,452,254	71,039,928	101,421,459
Wheat-flour ... bbls.	2,562,086	19,381,664	4,094,094	29,258,094
Other small grains and pulse ...	...	394,890	...	670,146
Other preparations of breadstuffs for food ...	...	424,552	...	322,443
Rice ... lbs.	276,637	19,740	558,922	27,075
Total breadstuffs, &c ...	...	98,762,891	...	161,225,939
Cotton and its manufactures:				
Sea-island ... lbs.	5,693,909	2,350,687	6,426,524	2,114,124
Other, unmanufactured ... do..	1,194,369,621	224,892,382	1,352,175,779	209,109,456
Colored goods ... yds.	3,585,629	596,912	4,625,180	668,781
Uncolored goods ... do..	10,187,145	1,655,116	13,247,142	1,681,209
All other ...	...	695,500	...	745,850
Total cotton, &c ...	...	230,190,597	...	214,319,420
Wood and its products:				
Boards, planks, joists, &c ... M ft.	236,557	4,625,863	228,481	4,242,389
Laths, palings, pickets, &c ... M.	2,614	10,345	5,386	22,382
Shingles ... do..	33,441	137,359	28,311	106,291
Box-shooks ...	...	263,277	...	63,856
Other staves and headings ...	...	6,091,771	...	6,456,391
Hogsheads and barrels, empty ... No.	145,277	267,195	170,348	355,777
All other lumber ...	...	249,872	...	164,131
Fire-wood ... cords.	6,324	18,366	2,721	9,279
Hop, hoop, and telegraph poles ...	...	672,893	...	1,028,584
Logs, masts, and other whole timber ...	...	707,979	...	641,361
Timber, sawed or hewn ... cub. ft.	14,154,244	2,731,635	25,209,048	4,422,160
All other timber ...	...	153,802	...	205,943
Household furniture ...	...	1,727,764	...	1,882,767
Wooden ware ...	...	237,097	...	240,350
Other manufactures ...	...	1,224,584	...	1,532,060
Ashes, pot and pearl ... lbs.	1,007,753	88,562	1,502,626	116,766
Bark for tanning ...	...	168,939	...	160,670
Rosin and turpentine ... bbls.	845,162	3,631,996	929,342	3,046,431
Spirits of turpentine ... galls.	5,114,653	2,667,386	6,784,173	2,758,933
Tar and pitch ... bbls.	43,535	177,435	71,920	238,779
Total value wood, &c ...	...	25,854,120	...	27,695,300
Miscellaneous:				
Brooms, brushes, &c ...	...	186,819	...	127,593
Cordage, ropes, &c ... lbs.	2,625,529	417,044	1,604,332	242,923
Fruits, apples, green, ripe, or dried ...	...	1,091,692	...	499,205
other green, ripe, or dried ...	...	292,935	...	211,308
preserved in cans, &c ...	...	318,678	...	283,649
Ginseng ... lbs.	350,141	341,144	400,619	448,760
Hay ... tons.	4,557	110,880	4,889	111,872
Hemp, unmanufactured ... cwt.	978	9,121	1,106	8,901
cordage, cables, &c ... do..	14,960	275,100	16,239	272,612
other manufactures ...	...	170,725	...	861,746
Hops ... lbs.	1,795,437	272,403	117,358	27,973
Liquors, alcoholic:				
Beer, ale, porter, cider, in bottles . doz.	3,443	7,712	2,897	6,945
In casks ... galls.	103,009	36,743	99,135	33,357
Spirits distilled from grain ... do..	654,365	359,646	1,893,800	982,287
From molasses ... do..	1,013,062	469,622	451,117	168,510
From other materials ... do..	35,656	23,371	20,548	13,819
Wine ... do..	46,715	48,202	48,141	45,534
Oil-cake ... lbs.	194,318,946	3,611,562	215,336,380	4,099,360
Oil, cotton-seed ... galls.	709,576	370,506	782,067	372,327
Linseed ... do..	47,453	46,087	22,047	22,692
Essential or volatile ...	...	128,233	...	151,430
Seeds, cotton ... lbs.	4,005,009	45,486	6,303,985	63,557
Flax or lint ... do..	490	1,345	286	907
All other ... do..	...	1,114,231	...	674,457
Starch ... do..	6,133,323	327,940	7,435,064	420,809

Statement of the exports of agricultural products of the United States, &c.—Continued.

	1873.		1874.	
	Quantity.	Value.	Quantity.	Value.
Sugar, brown .... lbs.	212, 625	$19, 647	163, 090	$16, 172
Refined .... do..	9, 870, 738	1, 142, 824	9, 969, 821	1, 041, 162
Molasses .... galls	3, 055, 836	611, 084	2, 447, 905	569, 972
Candy and confectionery	....	27, 873	....	30, 593
Tobacco, leaf .... lbs.	213, 995, 176	22, 689, 135	318, 097, 804	30, 399, 181
Cigars .... M.	215	7, 764	2, 458	24, 473
Snuff .... lbs.	12, 196	7, 462	15, 716	7, 092
Other manufactures	....	2, 627, 585	....	2, 537, 782
Vegetables and their preparations:				
Onions .... bush.	41, 881	53, 616	34, 105	52, 057
Pickles and sauces	....	11, 697	....	20, 784
Potatoes .... bush.	515, 306	498, 291	497, 413	471, 332
All other	....	122, 456	....	156, 078
Vinegar .... galls	19, 481	5, 097	25, 348	8, 122
Total value of miscellaneous	....	37, 901, 458	....	45, 486, 626

RECAPITULATION.

	1871.	1872.	1873.	1874.
Animals and animal matter	$47, 010, 312	$77, 060, 849	$99, 806, 599	$99, 607, 669
Breadstuffs, &c	79, 519, 387	85, 155, 523	98, 762, 891	161, 225, 939
Cotton, &c	221, 885, 245	182, 988, 925	230, 190, 597	214, 319, 420
Wood, &c	15, 820, 029	21, 425, 068	25, 854, 120	27, 695, 309
Miscellaneous	33, 069, 081	40, 139, 296	37, 901, 458	45, 486, 626
Total agricultural exports	397, 306, 054	406, 769, 659	492, 515, 665	548, 334, 954
Total exports	562, 518, 651	549, 219, 718	649, 132, 563	693, 039, 066
Percentage of agricultural matter	70	74	76	79

EXPORTS OF CEREALS.

Statement showing the quantity of wheat and flour exported from 1826 *to* 1874, *inclusive.*

Years.	Wheat, (bushels.)	Flour, (barrels.)	Total wheat and flour, (in bushels.)
Five years ending 1830	125, 547	4, 651, 940	23, 385, 247
Five years ending 1835	614, 145	5, 241, 964	26, 823, 965
Five years ending 1840	1, 842, 841	4, 092, 932	22, 307, 501
Five years ending 1845	2, 946, 861	6, 274, 697	34, 320, 346
Five years ending 1850	10, 184, 645	12, 284, 828	71, 608, 785
Five years ending 1855	16, 446, 955	13, 149, 518	82, 194, 545
Five years ending 1860	38, 808, 573	15, 778, 268	117, 699, 913
Five years ending 1865	138, 306, 907	19, 757, 733	237, 095, 572
Five years ending 1870	81, 808, 364	11, 454, 785	139, 082, 289
Total in forty-five years	291, 084, 838	92, 686, 665	754, 518, 163
1871	34, 304, 906	3, 653, 841	52, 574, 111
1872	26, 423, 080	2, 514, 535	38, 995, 755
1873	39, 204, 285	2, 562, 086	52, 014, 715
1874	71, 039, 928	4, 094, 094	91, 510, 398
Total in forty-nine years	462, 057, 037	105, 511, 221	969, 613, 142

Statement showing the value of breadstuffs exported from 1826 to 1874, inclusive.

Years.	Wheat.	Flour.	All bread-stuffs.
Five years ending 1830	$112, 754	$24, 708, 090	$42, 363, 119
Five years ending 1835	737, 365	29, 347, 649	48, 095, 362
Five years ending 1840	1, 817, 067	27, 231, 952	47, 114, 914
Five years ending 1845	2, 900, 785	31, 056, 156	51, 705, 513
Five years ending 1850	12, 801, 093	69, 375, 741	142, 232, 388
Five years ending 1855	21, 864, 762	75, 775, 220	134, 181, 567
Five years ending 1860	53, 343, 918	104, 368, 446	203, 046, 397
Five years ending 1865	178, 470, 444	133, 356, 875	364, 104, 797
Five years ending 1870	117, 327, 424	92, 071, 717	296, 056, 442
Total in forty-five years	389, 595, 612	587, 291, 846	1, 318, 900, 499
1871	45, 143, 424	24, 093, 184	79, 403, 689
1872	38, 915, 060	17, 955, 684	84, 615, 041
1873	51, 452, 254	19. 381, 664	98, 762, 891
1874	101, 421, 459	29, 258, 094	161, 225, 939
Total in forty-nine years	626, 527, 809	677, 980, 472	1, 742, 906, 059

Statement showing the quantity and value of wheat and flour exported, in decades.

Years.	Quantity.	Value.
	Bushels.	*Dollars.*
Five years ending 1830	23, 385, 247	24, 690, 844
Ten years ending 1840	49, 131, 466	59, 134, 033
Ten years ending 1850	105, 929, 131	116, 133, 775
Ten years ending 1860	199, 894, 458	255, 172, 346
Ten years ending 1870	376, 177, 861	521, 426, 460
Total	754, 518, 163	976, 687, 458

Statement showing the export price of wheat and flour.

Years.	Wheat per bushel.	Flour per barrel.
Ten years to 1840	$1 04	$6 06
Ten years to 1850	1 19	5 41
Ten years to 1860	1 35	6 23
Ten years to 1870	1 35	7 22

Statement showing the quantity and value of exports of corn and corn-meal.

Years.	Corn.		Corn-meal.		Total value.
	Bushels.		*Barrels.*		
Five years ending 1830	3, 530, 710	$2, 019, 926	783, 408	$2, 404, 371	$4, 424, 297
Five years ending 1835	2, 568, 946	1, 804, 711	817, 383	2, 731, 077	4, 535, 788
Five years ending 1840	1, 184, 973	873, 104	843, 930	3, 471, 215	4, 344, 319
Five years ending 1845	3, 474, 109	1, 755, 602	1, 132, 749	3, 037, 091	4, 792, 693
Five years ending 1850	43, 822, 153	31, 277, 920	2, 493, 700	8, 984, 252	40, 262, 172
Five years ending 1855	23, 905, 196	17, 712, 699	1, 121, 456	4, 147, 318	21, 860, 017
Five years ending 1860	27, 597, 896	19, 789, 181	1, 291, 342	4, 917, 515	24, 706, 696
Five years ending 1865	52, 612, 028	34, 903, 365	1, 176, 607	5, 323, 270	40. 226, 635
Five years ending 1870	47, 993, 276	47, 143, 817	1, 355, 024	7, 345, 448	54, 488, 265
Total in 45 years	206, 689, 287	157, 280, 325	11, 015, 599	42, 361, 487	199, 641, 812
1871	9, 826, 309	7, 458, 997	212, 641	951, 830	8, 410, 827
1872	34, 491, 650	23, 984, 365	308, 840	1, 214, 999	25, 199, 364
1873	38, 541, 930	23, 794, 694	403, 111	1, 474, 897	25, 269, 591
1874	34, 434, 606	24, 769, 951	387, 807	1, 529, 399	26, 299, 350
Total in 49 years	323, 983, 782	237, 288, 332	12, 327, 998	47, 532, 542	284, 820, 874

Statement showing the exportation of corn and corn-meal in decennial periods.

Years.	Corn.	Corn-meal.
	Bushels.	*Barrels.*
Five years ending 1830	8, 536, 710	783, 408
Ten years ending 1840	3, 753, 919	1, 661, 313
Ten years ending 1850	47, 296, 962	3, 626, 449
Ten years ending 1860	51, 503, 092	2, 412, 798
Ten years ending 1870	100, 605, 304	2, 531, 631
Total in 45 years	206, 689, 287	11, 015, 599

Statement showing the value of exports of corn and corn-meal in decennial periods.

Periods.	Corn.	Corn-meal.	Total value.
Five years ending 1830	$2, 019, 926	$2, 404, 371	$4, 424, 297
Ten years ending 1840	2, 677, 815	6, 202, 292	8, 880, 107
Ten years ending 1850	33, 033, 522	12, 021, 273	45, 054, 795
Ten years ending 1860	37, 501, 880	9, 064, 833	46, 566, 713
Ten years ending 1870	82, 047, 182	12, 668, 718	94, 715, 900
Total in 45 years	157, 280, 395	42, 361, 487	199, 641, 812

FLOUR AND GRAIN MOVEMENTS.

The early period at which this report was sent to press precluded the use of the annual reports of the boards of trade and other commercial corporations representing the leading markets of the country. The annual summaries prepared by commercial journals, though greatly improved in character and scope, and valuable as indicating the drift of trade-movements, are not very reliable as exact statements of facts and figures. They are too often hurried up to produce a sensation on New Year's day. They are also prepared with no concert of action, and with reference only to local views; consequently, they are only to a limited extent available for general statistics. Their results can only be given in a fragmentary form, showing the trade-movements at each local center, but not the articulation of different centers with each other. Some represent the calendar year, others the year ending June 30, and still others the year ending August 31. Some embrace all freight passing by rail or otherwise, without handling or transhipment. Others, more properly, include only the freight actually handled. The system of commercial statistics demands two leading reforms: First, a more careful and sifting local inquiry for facts; secondly, a common system, devised by some central representative authority, by which those facts can be accurately embodied in general formulæ and promptly published. The importance of such a system to our advanced civilization demands special attention and effort to secure the ends above indicated.

Our flour and grain movements have enormously increased, especially during the last two years. Our foreign shipments of wheat, flour, corn, oats, barley, and rye, during the fiscal year closing June 30, 1874, amounted to 128,642,760 bushels, flour in barrels being reduced to its equivalent of wheat in bushels. The aggregate of 1873 was 92,315,152 bushels; of 1872, 79,632,238 bushels; of 1871, 62,937,759 bushels; of 1870, 55,827,508 bushels; of 1869, 37,354,847 bushels. The total value of these exports, together with their preparations and other small

grains, in 1874, amounted to $161,755,748; in 1873, to $99,090,831; in 1872, to $85,155,523; in 1871, to $79,519,387; in 1870, to $72,485,775; in 1869, to $53,256,474. The exports of 1874, compared with 1873, increased nearly 40 per cent. in quantity and 63 per cent. in value. The exports of 1873, compared with the previous year, increased 16 per cent. in quantity and 16 per cent. in value; those of 1872, 26 per cent. in quantity and 6½ per cent. in value; those of 1871, 13 per cent. in quantity and 10 per cent. in value; those of 1870, 49 per cent. in quantity and 36 per cent. in value.

During the fiscal year ending June 30, 1874, we exported of the product of the previous calendar year, including wheat, corn, oats, barley, and rye, 8.4 per cent., against 5.5 per cent. in the fiscal year 1873, 5.2 per cent. in 1872, 3.8 per cent. in 1871, and 3.1 per cent. in 1870.

Of wheat, including flour reduced to bushels, the proportions of export to product were as follows, the percentage of each fiscal year being calculated on the product of the previous calendar year: 1874, 32.5 per cent.; 1873, 20.8 per cent.; 1872, 16.9 per cent.; 1871, 22.3 per cent.; 1870, 20.7 per cent.

Of corn the percentages were as follows: 1874, 3.7 per cent.; 1873, 3.5 per cent.; 1872, 3.9 per cent.; 1871, 0.9 per cent.; 1870, 0.15 per cent.

Of oats the percentages were as follows: 1874, 0.3 per cent.; 1873, 0.26 per cent.; 1872, 0.10 per cent.; 1871, 0.06 per cent.; 1870, 0.04 per cent.

Of barley the percentages were as follows: 1874, 1 per cent.; 1873, 1.8 per cent.; 1872, 0.3 per cent.; 1871, 1.3 per cent.; 1870, 0.9 per cent.

Of rye the percentages were as follows: 1874, 10.3 per cent.; 1873, 3.77 per cent.; 1872, 5.17 per cent.; 1871, 0.32 per cent.; 1870, 0.7 per cent.

These facts show that during the years under review we have been perceptibly increasing the rate of export of our cereal products, especially of wheat. That is, our surplus available for export is enlarging not only absolutely, but relatively; and in an increasing ratio, per annum. The next fiscal year, however, will show a much smaller percentage of export for the crop of 1874. The short crops of Europe for two years past explain this enormous increase in our exports of breadstuffs. The prospect of a good yield on the other side of the Atlantic had begun to react upon our shipments before midsummer. Seven months of the fiscal year ending June 30, 1875, show an export trade considerably smaller than the corresponding months of the previous fiscal year. Of wheat, the quantity is 35,962,629 bushels, against 45,825,549 in the corresponding period of the previous year. The export of corn is reduced from 18 millions to 17 millions.

In the marketing of our breadstuffs New York still holds the preeminence, but other cities are increasing their trade at more rapid rates. During 1874 there was a marked variation in the lines of transportation by which some sections of the country marketed their produce. The following *résumé* of our leading markets will give some idea of the magnitude of our cereal trade:

NEW YORK.

The total receipts of wheat, (including flour,) corn, oats, rye, and barley, at New York, during the calendar year of 1874, amounted to 105,387,283 bushels, against 93,544,128 bushels in 1873, an increase of 12 per cent.; shipments, 72,070,936 bushels, against 52,564,024 bushels in 1873, an increase of 37 per cent. Of these aggregates 59 per cent. of the receipts and 89 of the shipments, or 61,903,250 bushels of the former, and 45,855,380 bushels of the latter, represent flour and wheat,

which together show an increase over the previous year of 16 per cent. in the receipts, and 27 per cent. in the exports. The total receipts of flour increased 13 per cent., and the exports 50 per cent., amounting to about 60 per cent. of the total foreign export of the fiscal year 1874. Of wheat the receipts increased 17 per cent., and the exports 20 per cent., constituting about 47 per cent. of the exports of the country. The receipts of corn increased 19 per cent., and the exports 71 per cent., amounting to about three-fourths of the entire export of the country. The receipts of oats declined 4 per cent., while the exports nearly tripled in volume, constituting about one-seventh of the entire national export. The receipts of barley increased 13 per cent., while the exports almost ceased. The receipts and exports of rye declined about 40 per cent. each, yet amounted to 40 per cent. of the total rye exports. The disproportion in the increase of exports over receipts, has left a greater exhaustion of supplies in New York, as is shown by the reduced stocks on hand at the close of the last two years.

The flour and grain movements for three years were as follows:

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments
Flour .... barrels.	3, 042, 907	1, 202, 792	3, 546, 568	1, 655, 331	4, 017, 207	2, 462, 728
Wheat .... bushels.	16, 238, 433	13, 299, 320	35, 559, 870	27, 801, 829	41, 817, 215	33, 541, 740
Flour and wheat ...... do...	31, 452, 968	19, 313, 280	53, 292, 710	36, 078, 484	61, 903, 250	45, 855, 380
Corn .... do...	40, 800. 939	25, 652, 603	24, 576, 345	15, 416, 787	29, 329, 000	26, 447, 807
Oats .... do...	12, 442, 127	32, 718	11, 235, 420	49, 573	10, 792, 919	122, 528
Rye .... do...	491, 851	623, 355	925, 447	1, 069, 140	592, 114	641, 661
Barley .... do...	3, 964, 441	17, 402	2, 444, 206	40, 040	2, 770, 000	3, 560
Total	89, 196, 326	45, 639, 358	92, 751, 128	52, 654, 024	105, 387, 283	73, 040, 936

The total value of the flour, grain, bread, and other breadstuffs exported from New York during the calendar year 1874, was $81,161,763, including the following items: barley, $317; bread and biscuit, $523,633; corn, $15,967,763; corn-meal, $820,158; oats, $82,381; rye, $685,982; rye-flour, $49,502; wheat, $47,873,442; wheat-flour, $14,111,815; other small grains and pulse, $765,091; maizena, and all other preparations from breadstuffs for food, $281,679.

BOSTON.

The total receipts of grain, including flour, reduced to its equivalent in wheat, amounted to 17,608,223 bushels in 1874, an increase of less than 1 per cent. over the previous year. Of flour, the receipts were 1,890,487 barrels, an increase of 5⅓ per cent., and the shipments, foreign and coastwise, 287,718 barrels, an increase of nearly 25 per cent. Of wheat, the receipts were 1,362,366 bushels, an increase of 54 per cent.; the shipments were 1,062,366 bushels, an increase of 119 per cent. The receipts of wheat and flour together were 10,814,452 bushels, an increase of nearly 10 per cent.; shipments, 2,500,956 bushels, an increase of 52 per cent. The receipts of flour and wheat constitute 61 per cent. of the entire receipts of cereals against 56 per cent. in 1873. The receipts of corn amounted to 3,303,641 bushels, a decrease of 7 per cent.; shipments, 380,254 bushels, an increase of 133 per cent. The receipts of oats were 3,037,269 bushels, a decrease of 18 per cent.; of rye, 34,273 bushels, an increase of 3 per cent.; of barley, 418,615 bushels, an increase of 26 per cent.

The receipts of the old crop of wheat were readily marketed at high prices, on account of the European demand, but the prices of the copious new crop rapidly fell, reaching an unusual minimum. The quality of the wheat marketed at Boston during the year was superior, especially the white wheat flours, which surpassed the product of any former year. "Patent" spring flours multiplied during the year, realizing good prices. Some of these have maintained their reputation, but others have declined. Prices of flour ran very low, declining through the year with a slight reaction toward the close. The range of prices on the first day of each month was from $4.50 to $11 per barrel; the closing prices were $2.50 to $3 less for the same grade than at the beginning of the year. Corn and oats sustained themselves better than during previous years; corn ranged from 82 cents to $1.06 per bushel, and oats, 52 cents to 72 cents; rye from $1 to $1.25.

The grain-movement of the last three years was as follows:

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour .... barrels..	1, 586, 017	217, 586	1, 795, 272	231, 361	1, 890, 487	287, 718
Wheat .... bushels..	402, 426	151, 860	880, 747	486, 128	1, 362, 017	1, 062, 366
Flour and wheat .... do...	8, 332, 511	1, 239, 790	9, 857, 107	1, 642, 933	10, 814, 452	2, 500, 956
Corn .... do...	5, 090, 755	1, 673, 769	3, 558, 363	162, 729	3, 303, 641	380, 254
Oats .... do...	2, 725, 641	....	3, 663, 364	....	3, 037, 269	....
Rye .... do...	13, 989	....	33, 335	....	34, 273	....
Barley .... do...	529, 038	....	332, 849	....	418, 615	....
Total	16, 701, 924	....	17, 445, 018	....	17, 608, 250	....

PHILADELPHIA.

The receipts of flour in 1874 were 40 per cent. greater than in 1873; the receipts of wheat increased 25 per cent.; barley, 26 per cent. On the other hand, there was a decline in the receipts of corn of nearly 28 per cent., of oats, 21 per cent., and of rye nearly 23 per cent. The receipts and shipments of the past three years were as follows:

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour .... barrels..	987, 450	113, 036	994, 680	142, 386	1, 401, 700	....
Wheat .... bushels..	4, 160, 800	412, 761	4, 372, 800	1, 938, 310	5, 471, 700	....
Flour and wheat .... do...	9, 098, 050	977, 941	9, 346, 200	2, 650, 240	12, 480, 200	....
Corn .... do...	8, 137, 380	3, 462, 473	8, 233, 400	2, 002, 368	5, 954, 700	....
Oats .... do...	5, 830, 400	....	5, 980, 565	....	4, 705, 000	....
Rye .... do...	320, 940	....	322, 600	....	249, 091	....
Barley .... do...	730, 380	....	1, 066, 392	....	1, 236, 392	....
Total	24, 117, 150	....	24, 949, 157	....	24, 625, 383	....

The flour and wheat movement exceeds that of any former year, while transactions in corn are less than in three years previous. The oats trade also shows a great reduction, making the total receipts of flour and grain below last year.

BALTIMORE.

The flour and grain trade of Baltimore, during 1874, showed a great enlargement. The aggregate receipts of flour and wheat consolidated, and of corn, oats, and rye, amounted to 24,699,250 bushels, an increase of nearly 30 per cent. over 1873. While the receipts of oats declined 9 per cent. all the other articles were handled in larger quantities. The receipts of flour increased 17 per cent. and the shipments 32 per cent. The receipts of wheat increased 127 per cent. and the shipments 208 per cent. Of flour and wheat taken together, the receipts increased over 50 per cent., and the shipments more than doubled. Of corn, the receipts increased 12 per cent., while the shipments slightly declined. The receipts of rye increased 18 per cent. Barley was handled in quantities too small to excite observation.

The production of flour by the city mills greatly increased, amounting to 297,935 barrels in 1874, against 258,589 barrels in 1873. Since the repeal of the State inspection-laws, the term "city mills" has been applied more extensively than formerly, and now includes several mill-properties on the Patapsco River outside the city limits, the produce of which was formerly classed as "western flour." Including these, the "city-mill" product of 1874 amounted to 507,035 barrels. These establishments include quite a number devoted exclusively to high-grade flour, which finds a strong demand in Europe and South America. Choice Baltimore and choice Saint Louis brands for years shared the supremacy of the eastern markets, but of late they have found formidable rivals in the "patent" spring-wheat brands of the Northwest. Baltimore is a leading point of shipment to the South, and is increasing its trade in that direction. Prices, during 1874, were unprecedentedly low. Howard-street super fell from \$5.50 @ \$6 per barrel, January 1, to \$4 @ \$4.50 December 15; western extra from \$6.25 @ \$7 to \$4.75 @ 5.25; city mills extra from \$8.25 @ \$8.50 to \$6.50 @ \$6.75. Southern red wheat opened at \$1.50 @ \$1.87 per bushel, and fell by the 1st of November to \$1.15 @ \$1.30, with a slight subsequent reaction; southern white wheat fell from \$1.70 @ \$1.90, January 1, to \$1.15 @ \$1.30, November 1. The prices of wheat on the 1st day of each month were uniformly lower than in 1873. The price of corn rose from 70 cents to 80 cents per bushel in January to \$1 to \$1.03 in October, but fell to 80 cents @ 85 cents in December; southern corn was in fair supply, but western fell off greatly. Prices of oats rose from 51 cents @ 54 cents per bushel in January to 70 cents @ 74 cents in June, but declined to 63 cents @ 66 cents in December. Rye fluctuated in price, the quotations January 1 being 90 cents @ 98 cents and \$1 @ \$1.05 December 1, the minimum, 75 @ 80 cents, being in August. The grain and flour movements of three years were as follows:

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour .... barrels..	1, 175, 967	282, 553	1, 312, 612	359, 566	1, 539, 237	474, 758
Wheat .... bushels..	2, 456, 100	88, 025	2, 810, 917	1, 158, 097	6, 369, 834	3, 556, 848
Flour and wheat...... do....	8, 335, 935	1, 500, 790	9, 373, 977	2, 955, 927	14, 066, 019	5, 930, 638
Corn .... do....	9, 045, 465	5, 157, 235	8, 330, 449	6, 003, 618	9, 355, 467	5, 959, 757
Oats.................. do....	1, 959, 161	....	1, 255, 072	....	1, 139, 216	....
Rye .... do....	90, 938	....	100, 519	....	118, 548	....
Total	19, 431, 499	....	19, 070, 017	....	24, 699, 250	....

CINCINNATI.

The statistics of Cincinnati are prepared under the direction of the chamber of commerce, and represent commercial years ending August 31. The latest report published closes August 31, 1874, and consequently embraces the movement of only a small portion of the last crops of cereals. The flour-trade about held its own during the last commercial year, the receipts being 9,447 barrels more than during the previous year, while the shipments declined 9,055 barrels. The loss in shipments is attributed to the small margin between Cincinnati prices and those of Eastern markets. This has cut down the Eastern trade; the exports down the Ohio River have also fallen off slightly, but to the up-river ports the shipments increased 23,769 barrels. The trade with Virginia and the Southeast is enlarging. A strong and discriminating local demand has induced the production on a large scale of fine-grade flour. Spring-flour is also in greater request, some brands bringing 40 to 50 cents per barrel more than similar grades of winter-flour. The sources of supply did not materially change during the year. The quality of the flour marketed during the last year was excellent. A new process has proved successful in the separation of high grades of flour from middlings. Prices during the year, rose from \$7 per barrel for family-flour at the beginning to \$7.50, but receded to \$5.20 as the abundant new crop made its leveling influence felt. The average price of family was \$6.60.4 against \$7.46.8 during the previous year. The average price of superfine flour during the last commercial year was \$5.06¼ per barrel, against \$5.56¼ in 1872–'73, and \$6.06 in 1871–'72.

The grain-market of 1874 greatly improved. Cincinnati has been one of the best local markets in the Union, but of late it has shown a tendency to become a distributing market. Facilities of transportation are improving, and greater energy is manifested in the prosecution of this branch of trade. The receipts of unmanufactured wheat increased 42 per cent., while the shipments increased 89 per cent. The quality of the receipts of the crop of 1873 was below average; the grain, having been poorly harvested, was light and frequently stained. The crop of 1874, however, was in marked contrast, being in quality one of the best on record. The average price for red winter-wheat No. 2 was \$1.37.9 per bushel, against \$1.56.3 in the previous year.

Of corn, the receipts by rail and river increased about 20 per cent. and shipments over 100 per cent., the largest trade of any year in the history of the city. These figures do not embrace the corn brought into the city from the country immediately around. Starch-factories in the vicinity consumed 744,649 bushels of corn not included in the market reports of the chamber of commerce. The aggregate receipts of the city and its immediate vicinity were not less than 3,500,000 bushels. The shipments East and South both increased. The transactions of the year were quite satisfactory, embracing only the crop of 1873, which was inferior to its predecessor in quantity and quality. The demand was good and prices advanced. The monetary panic, occurring about the advent of the new crop, cut down quotations to 43 cents per bushel, but by a constant appreciation they rose to 70 cents before the close of the year; the average was 60 cents, against 42.6 cents during the previous year.

The receipts of oats fell off nearly 10 per cent. and the shipments 33 per cent. The returns do not include receipts by wagons, which are known to be quite large. There was but small accumulation of stocks at any time during the year. The first receipts of the crop of 1874

were clean and well harvested, but deficient in weight. Prices ruled high; No. 2, mixed, averaged 48.2 cents per bushel, against 36.1 the previous year; the maximum, 68, was in July.

The receipts of rye diminished nearly 10 per cent., while the shipments increased 90 per cent. The demand was local, but well sustained. Prices of No. 2 averaged 92.9 cents per bushel, against 75.8 the previous year; the maximum, $1.18, was in May, and the minimum, 70 cents, in November.

The receipts of barley fell off nearly 12 per cent., while the shipments increased at the rate of 142 per cent. It is estimated that 300,000 bushels were received by wagons from the neighboring country, of which the statistical authority takes no cognizance. Most of the import is for local consumption. A steady demand made prices high, No. 2 fall-barley averaging $1.51¼, against 86.9 cents the previous year.

The following table shows the movements of flour and grain at Cincinnati during the last three commercial years:

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour .... barrels.	582, 930	410, 501	765, 469	560, 829	774, 916	551, 774
Wheat .... bushels.	762, 144	323, 405	860, 454	412, 722	1, 221, 176	783, 990
Flour and wheat .... do..	3, 676, 794	2, 375, 910	4, 687, 799	3, 216, 767	5, 095, 756	3, 542, 860
Corn .... do..	1, 892, 866	246, 632	2, 259, 544	324, 183	3, 457, 164	658, 718
Oats .... do..	1, 160, 053	230, 963	1, 520, 979	324, 718	1, 372, 464	216, 669
Rye .... do..	357, 309	110, 464	426, 660	61, 577	385, 934	117, 349
Barley .... do..	1, 177, 306	26, 964	1, 228, 245	37, 456	1, 084, 500	90, 638
Total	8, 264, 328	2, 990, 953	10, 123, 227	3, 964, 801	11, 395, 818	4, 626, 275

CHICAGO.

The receipts of flour in Chicago during 1874, compared with 1873, increased 4 per cent., while the home manufacture declined 5 per cent. and the shipments 2 per cent. The trade of the year was dull and unprofitable. Before midsummer the certainty of an immense wheat-crop, both in this country and in Europe, foreshadowed a rapid decline in the transatlantic demand for breadstuffs. Prices in Chicago reacted so suddenly, that many millers and dealers changed their shipments to other points, especially to the eastern cities, thus forestalling a demand which constituted one of the main springs of Chicago trade. Flour-manufacture has not increased since the great fire of 1871, though new machinery was set at work at the close of 1874, promising a considerable increase during the coming year. Complaints are made that till lately the practical operation of the warehousing system was unfavorable to the milling interest. But later arrangements have been made, by which millers can obtain wheat by sample from any part of the country. The superior Chicago brands are mostly shipped to points within the United States; the medium grades go to Canada and Europe. The latter, known as shipping spring extras, ranged from $4 to $6 per barrel during the year, averaging $5.01. Winter-flours were in market in such abundance as to render them for a time practically unsalable. The improvements in spring-flour manufacture have enlarged the sale of that class, and caused it to take the place of winter-flour of the same grade, and at lower prices. The flour manufactured during 1874

amounted to 251,000 barrels, against 264,363 barrels in 1873, 186,968 in 1872, 327,739 in 1871, and 443,967 in 1870.

The receipts of wheat increased 14.8 per cent., and the shipments 11.8 per cent. During the early part of the year low railroad-freights caused a rapid movement, while prices declined slowly but steadily. But both the movement and the prices fell off with the opening of navigation. As the increased yield of Europe became more evident, buyers began to hold back; and when our own plentiful crop of 1874 began to come into the Chicago and Milwaukee markets in great abundance, prices came down very suddenly. Yet, even with this great disturbance, the range of fluctuation was narrower than during the preceding year. No. 2 spring ranged from 81½ cents to $1.28½ per bushel, a difference of 47 cents against 59 cents in 1873; the average was $1.08¾ against $1.17½ the previous year. The causes which rendered the trade disastrous to legitimate operations at the same time removed motives to illegitimate combinations. Parties who had purchased largely in anticipation of "corners," were compelled to sell at a heavy loss. The danger of speculating upon the foreign demand was never more fully realized in actual experience.

The short corn-crops of 1873 and 1874 are sufficient as a general explanation of the smaller volume of that branch of the grain-trade. The receipts of 1874 were 7.7 per cent. below those of 1873, which, in turn, had declined 19 per cent. from 1872; the shipments of 1874 show a decline of 10.79 per cent., and those of 1873 of 21.8 per cent., from the previous year. Yet, with the heavy decline in receipts, the average price of 1873 was 37 cents per bushel against 38½ in 1872. The still shorter crop of 1874 raised the average of that year to 65 cents. This increased price gave a total value to the receipts of 1874 about 62 per cent. greater than in 1873. Prices in 1874 exhibited considerable fluctuations, reaching the maximum, 85½, in November. The dry summer was favorable to the early maturity of the new crop, which, sooner than usual, came in competition with the old one. The market was kept during several months in a chronic state of excitement by combined efforts to "corner" the crop. The decline of iron-production in the Northwest rendered available a large amount of cheap lake-transportation, which, according to commercial estimates, attracted at least 6,000,000 bushels to Chicago, which otherwise would have reached the Eastern markets through other channels.

The oats-trade declined about 30 per cent. in both receipts and shipments. The market was disturbed by speculative movements, which caused both gains and losses on a considerable scale. Under the operation of these influences, market-quotations frequently represented imaginary and not legitimate values. The average price of No. 2, in 1872, was only 29½ cents per bushel, though at one time "cornered" up to 43¼ cents. The large crop of 1873 averaged 28¾ cents; in 1874 the average was 46 cents, being "cornered," in July, up to 85 cents. Shippers of oats from Chicago realized better profits than usual.

The receipts of rye during 1874 were only 755,769 bushels, against 1,189,464 bushels in 1873, a loss of nearly 30 per cent.; shipments, 339,892, but little more than a third of those of the previous year. A light supply with a fair demand kept stocks down to a very low point, bringing the trade within easy manipulation. The conservative character of the controlling influences of the market is shown by the narrow range of prices—from 77 cents to $1.01 per bushel, or 24 cents against 35 cents in 1873, and 43 cents in 1872. The quality of the crop

handled here was good, the proportion of "rejected" being less than the average of former years.

The receipts of barley declined 23 per cent., and the shipments nearly 35 per cent. The expectation of lower prices was consequently disappointed. The range for No. 2 was from 90 cents to $2 per bushel, against 50 cents to $1.58 in 1873, a difference of 40 to 42 cents. The market was greatly disturbed by speculative movements at different periods.

The total receipts of all classes of cereals, including flour reduced to its equivalent of wheat, were 95,208,041 bushels, a loss of 5 per cent. The shipments were 84,928,572 bushels, or 8½ per cent. less than the previous year. The comparative receipts and shipments of the last three years were as follows:

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour..................barrels.	1,532,014	1,361,328	2,487,376	2,303,490	2,591,525	2,249,338
Wheat...............bushels.	12,724,141	12,160,046	26,266,562	24,455,657	30,177,076	27,353,635
Flour and wheat..........do..	20,384,211	18,966,686	38,703,442	35,973,107	43,134,701	38,600,325
Corn........................do..	47,366,067	47,013,552	38,157,232	36,754,943	35,215,041	32,806,370
Oats........................do..	15,061,715	12,255,537	17,888,724	15,694,133	12,855,417	10,777,201
Rye.........................do..	1,129,066	776,805	1,189,464	960,613	755,769	339,892
Barley......................do..	5,251,750	5,032,308	4,240,239	3,366,041	3,247,113	2,404,784
Total......................	89,192,849	84,074,888	100,179,101	92,748,837	95,208,041	84,928,572

SAINT LOUIS.

The flour and grain trade of Saint Louis, during 1874, considerably enlarged its general aggregates in spite of a decline in the receipts of corn and rye. The increase has been mainly in flour and wheat, both of which show a large advance upon the previous year. The number of barrels of flour manufactured was 1,581,000, an increase of 11 per cent. The receipts of flour manufactured elsewhere amounted to 1,583,604 barrels, an increase of 18 per cent. The total amount of flour handled was 3,164,604 barrels, an aggregate of 14 per cent. greater than that of the previous year, and equal to three-fourths of the flour-receipts of New York. The shipments were 2,967,947 barrels, showing an increase of 18 per cent., and equaling about three-fourths of the foreign shipment of the country. Saint Louis is the greatest flour-manufacturing center in the world, and is annually enlarging her enterprise in this direction, while her commercial transactions are increasing at a still more rapid rate. Yet the year 1874 is complained of in her commercial circles as a dull year. The milling interest realized but slender profits and found great difficulty in maintaining itself. It was aided by the extraordinary demand for the offal of its immense flour-product, which was rapidly disposed of at high prices. The prices of flour of all grades showed a steady decline during the first ten months of the year, with a partial reation toward its close. Spring extra fell from $6.75 @ $6.25 per barrel in January to $4 @ $4.50 in November, but rallied in December to $4.50 @ $4.65; club declined from $6.50 @ $7 to $4.50 @ $5, and rose again to $5 @ $5.30; winter XX fell from $6.25 @ $6.50 to $3 @ $4.85, afterward rising to $4.55 @ $4.70; family fell from $7.50 @ $9.50 to $5.40 @ $6.75, with a reaction to $5.50 @ $6.40. These figures sufficiently explain the embarrassment of the milling interest during 1874.

The receipts of wheat increased 28 per cent. and the shipments nearly 60 per cent. The combined receipts of wheat and flour, reduced to wheat, increased nearly 25 per cent., and the shipments 21 per cent. The wheat handled in this market during this year was almost exclusively winter-grain, which was in such abundant supply that prices steadily declined throughout the year; No. 2, red winter, fell from $1.63 per bushel, at the beginning of the year, to $1.05 at its close; spring-wheat from $1.12 and $1.24 to 88 cents and 92½ cents.

The receipts of corn fell off 9 per cent., but the market-price rose to an average of 70 cents per bushel during 1874, against 40 cents in 1873, making the money-value of the corn-trade of 1874, as well as the profits of the Saint Louis dealers, much greater than during the previous year. The close of 1874, however, showed a decline from the high figures previously ruling.

The receipts of oats show a small increase, while the prices ruled much higher than the previous year. No. 2, white, opened in January at 46 and 46½ cents per bushel, and gradually rose at the end of the year to 57 and 57½ cents. The receipts of barley showed a considerable increase, the prices at the end of the year being lower than at the beginning. Rye decreased in quantity, but advanced in price through the year from 80 cents and 85 cents per bushel in January to 97½ cents and $1.05 at the close of December.

The flour and grain movements of the last three years were as follows:

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Flour..............barrels.	1, 259, 933	2, 247, 040	1, 296, 457	2, 506, 215	1, 583, 604	2, 967, 949
Wheat............bushels.	6, 007, 987	918, 477	6, 185, 038	1, 210, 286	7, 909, 437	1, 932, 126
Flour and wheat....bushels.	12, 307, 652	12, 153, 677	12, 667, 323	13, 741, 361	15, 827, 457	16, 771, 871
Corn..................do....	9, 479, 387	8, 029, 739	7, 701, 787	5, 216, 916	6, 984, 916	4, 118, 947
Oats..................do....	5, 467, 800	3, 464, 594	5, 359, 853	3, 215, 206	5, 258, 025	3, 979, 416
Rye...................do....	377, 587	150, 208	356, 580	206, 652	284, 332	163, 720
Barley................do....	1, 263, 486	87, 566	1, 158, 615	125, 604	1, 402, 669	219, 610
Total...........do....	28, 895, 912	23, 885, 784	27, 243, 158	22, 505, 739	29, 757, 399	25, 253, 564

The manufactures of 1872 were 1,294,798 barrels; of 1873, 1,420,287 barrels; of 1874, 1,581,000 barrels.

SAN FRANCISCO.

The statistics of San Francisco are reported by "harvest-years," closing June 30. During the harvest-year ending in 1874 the receipts of flour amounted to 1,878,132 quarter sacks, against 889,116 quarter sacks the previous year; the exports amounted to 644,710 barrels, against 263,645 barrels the previous year. The receipts of the last six months of the calendar year 1874 were 274,021 barrels, of which 250,609 barrels were made in California, and 23,412 barrels in Oregon. The receipts of the last six months of 1873 were 308,527 barrels, of which 262,048 were from California, and 46,459 were from Oregon. The exports by sea for the last half of 1874 were 219,016 barrels, worth $1,134,722, against 328,031 barrels, worth $2,076,426, during the same period of 1873. During the last two years a very large export was directed to Great Britain, but this trade is not regarded as permanent, as it was the result of the short crops of Europe for two or three years prior to 1874. A very large and regularly increasing export to China, Japan,

and the Pacific islands is noted. During high prices of grain in Europe it is found that the exports of flour to that continent greatly increase, but in years of greater abundance at home, English buyers prefer to ship California wheat, to be manufactured into flour in England. The flour manufacture of San Francisco has been greatly enlarged of late years. High grades, which are produced in increasing perfection, find an enhanced home demand, while superfines are in request for export to Asia and Polynesia. The exports of flour, with their aggregate values, during the last four calendar years, were as follows: 1871, 232,094 barrels, valued at $1,514,637; 1872, 247,088 barrels, worth $1,-330,391; 1873, 479,418 barrels, valued at $2,898,980; 1874, 535,695 barrels, valued at $3,042,900.

Of wheat, the receipts of the harvest-year ending June 30, 1874, were 7,829,821 centals, or 13,049,701 bushels, against 10,780,895 centals, or 17,968,158 bushels the previous year. The receipts of the six months ending December 1, 1874, were 6,566,203 centals, or 10,943,671 bushels, against 6,043,997 centals, or 10,073,328 bushels during the same portion of 1873. The exports of the latter half of 1874 were 5,488,186 centals, or 9,146,976 bushels, worth $8,625,830; during the latter half of 1873 the export amounted to 4,706,757 centals, or 7,844,595 bushels, valued at $9,979,811. The quantities and values exported during the last four *calendar* years were as follows: 1871, 1,311,679 centals, or 2,186,131 bushels, valued at $3,178,635; 1872, 6,071,383 centals, or 10,118,971 bushels, valued at $10,671,004; 1873, 9,175,960 centals, or 15,293,266 bushels, valued at $18,658,744; 1874, 8,054,670 centals, or 13,424,450 bushels, valued at $14,144,150.

The sudden change in English markets to medium and low prices during the latter half of 1874 greatly affected the export of flour and wheat, yet there was a partial reaction of prices in San Francisco at the close of the year, in spite of the fact that the warehouses in the interior were full of wheat, a large portion of which had been withheld from market in anticipation of higher prices. The total receipts of wheat, including flour reduced to wheat, during the harvest-year ending June 30, 1874, were 15,497,365 bushels, against 19,079,555 during the previous year. During the latter half of 1874 the receipts were 12,313,771 bushels, against 10,943,671 in the same period of 1873. The exports of the last harvest-year were 15,345,615 bushels against 17,699,370 bushels the previous year. The exports of the last half of 1874, which is the first half of the current harvest-year, were 10,242,056, against 16,663,018 bushels during the last half of 1873. The quantities and values exported during the last four *calendar* years were as follows: 1871, 3,346,601 bushels, valued at $4,693,272; 1872, 11,354,411 bushels, valued at $12,001,395; 1873, 17,690,356 bushels, valued at $21,557,724; 1874, 16,102,925 bushels, valued at $17,287,050.

The production and marketing of corn on the Pacific coast are on too small a scale to attract notice in general statistics. The rye-trade was also very limited. The California oats-crop was ordinary in quantity and quality, but prices were kept down by heavy receipts from Oregon; amounting during the last half of 1874 to 85,335 centals. The receipts of the harvest-year ending June 30, 1874, were 243,400 centals, against 200,545 centals the previous year; the exports were 27,640 centals, against 5,437 centals the previous year. The demand from Australia during the latter half of 1874 greatly stimulated the oats movement, the total receipts for six months being 243,933 centals, and the shipments 52,908. The exports of the last four calendar years were as follows: 1871, 7,832 centals, worth $14,861; 1872, 10,170 centals

worth $17,983; 1873, 5,725 centals, worth $12,129; 1874, 78,354 centals worth $130,127.

The receipts of barley for the harvest-year ending in 1874 were 1,127,390 centals, against 981,028 the previous year; the exports were 243,758, against 226,927 the previous year. A still greater increase is noted during the last half of 1874, or first half of the current harvest-year, the receipts, 912,478 centals, amounting to nearly the aggregate of the previous twelve months; the exports for six months were 178,073. The increase in the exports arises from a demand in the States east of the Mississippi. In the fall of 1873 a few hundred tons were shipped eastward by rail, but early in 1874 the movement received a great impulse, and amounted during the year to 350,000 centals. The business of 1875, however, foreshadows a great reduction from exhaustion of supplies. The crop of 1874 was good, and its large surplus has been disposed of at good prices. The exceptional eastern demand depleted the stocks available for brewing, and consequently the country was scoured for desirable crop parcels. All kinds of barley sympathize in the high prices thus created. The farmers have been encouraged to increase their barley acreage. The market was firm at the close of the year.

RECAPITULATION.

The comparative flour and grain receipts and shipments at the above-named points are shown in the following tables:

Flour, barrels.

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	3,042,907	1,202,792	3,546,568	1,655,331	4,017,207	2,462,728
Boston	1,586,017	217,586	1,795,272	231,361	1,890,487	287,718
Philadelphia	987,450	113,036	994,680	142,386	1,401,700	....
Baltimore	1,175,967	282,553	1,312,612	359,566	1,539,237	474,758
Cincinnati *	582,930	410,501	765,469	560,829	774,916	551,774
Chicago	1,532,014	1,361,328	2,487,376	2,303,490	2,591,525	2,249,338
Saint Louis	1,259,933	2,247,040	1,296,457	2,506,215	1,583,604	2,967,949
San Francisco	....	247,088	....	479,418	....	535,695

* Commercial years ending August 31.

Wheat, bushels.

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	16,238,433	13,299,320	35,559,870	27,801,829	41,817,215	33,541,740
Boston	402,426	151,860	880,747	486,128	1,362,017	1,062,366
Philadelphia	4,160,800	412,761	4,372,800	1,938,310	5,471,700	....
Baltimore	2,456,100	88,025	2,810,917	1,158,097	6,389,834	3,556,848
Cincinnati *	762,144	323,405	860,454	412,722	1,221,176	783,990
Chicago	12,724,141	12,160,046	26,266,562	24,455,657	30,177,076	27,353,635
Saint Louis	6,007,987	918,477	6,185,038	1,210,286	7,909,437	1,932,126
San Francisco	....	10,118,971	....	15,293,266	....	13,424,450

* Commercial years ending August 31.

Wheat, including flour, reduced to wheat-bushels.

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	31, 452, 968	19, 313, 280	53, 292, 710	36, 078, 484	61, 903, 250	45, 855, 380
Boston	8, 332, 511	1, 239, 790	9, 857, 107	1, 642, 933	10, 814, 452	2, 500, 956
Philadelphia	9, 098, 050	977, 941	9, 346, 200	2, 650, 240	12, 480, 200	....
Baltimore	8, 335, 935	1, 500, 790	9, 373, 977	2, 955, 927	14, 086, 019	5, 930, 638
Cincinnati *	3, 676, 794	2, 375, 910	4, 687, 799	3, 216, 867	5, 095, 756	3, 542, 860
Chicago	20, 384, 211	18, 966, 686	38, 703, 442	35, 973, 107	43, 134, 701	38, 600, 325
Saint Louis	12, 307, 652	12, 153, 677	12, 667, 323	13, 741, 361	15, 827, 457	16, 771, 871
San Francisco	....	11, 354, 411	....	17, 690, 356	....	16, 102, 925

* Commercial year ending August 31.

Corn, bushels.

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	40, 800, 939	25, 652, 603	24, 576, 345	15, 416, 787	29, 329, 000	26, 447, 807
Boston	5, 090, 755	1, 673, 769	3, 558, 363	162, 729	3, 303, 641	380, 254
Philadelphia	8, 137, 380	3, 462, 473	8, 233, 400	2, 002, 368	5, 954, 700	....
Baltimore	9, 045, 465	5, 157, 235	8, 330, 449	6, 003, 618	9, 355, 467	5, 959, 757
Cincinnati *	1, 892, 866	246, 632	2, 259, 544	324, 183	3, 457, 164	658, 718
Chicago	47, 366, 087	47, 013, 552	38, 157, 232	36, 754, 943	35, 215, 041	32, 806, 370
Saint Louis	9, 479, 387	8, 029, 739	7, 701, 787	5, 216, 916	6, 984, 916	4, 116, 947

* Commercial years ending August 31.

Oats, bushels.

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	12, 442, 127	32, 718	11, 235, 420	49, 573	18, 792, 919	122, 528
Boston	2, 725, 641	....	3, 663, 364	....	3, 037, 269	....
Philadelphia	5, 830, 400	....	5, 980, 565	....	4, 705, 000	....
Baltimore	1, 959, 161	....	1, 255, 072	....	1. 139, 216	....
Cincinnati *	1, 160, 053	230, 963	1, 520, 979	324, 718	1, 372, 464	216, 660
Chicago	15, 061, 715	12, 255, 537	17, 888, 724	15, 694, 133	12, 855, 417	10, 777, 201
Saint Louis	5, 467, 800	3, 464, 594	5, 359, 853	3, 215, 206	5, 258, 025	3, 972, 416
San Francisco	....	31, 781	....	17, 891	....	244, 856

* Commercial years ending August 31.

Rye, bushels.

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	491, 851	623, 355	995, 447	1, 069, 140	592, 114	641, 661
Boston	13, 929	....	33, 335	....	34, 273	....
Philadelphia	320, 940	....	322, 600	....	249, 091	....
Baltimore	90, 938	....	100, 519	....	118, 548	....
Cincinnati*	357, 309	110, 464	426, 660	61, 577	385, 934	117, 349
Chicago	1, 129, 086	776, 805	1, 189, 464	960, 613	755, 769	339, 892
Saint Louis	377, 587	150, 208	356, 580	206, 652	284, 332	163, 720

*Commercial years ending August 31.

Barley, bushels.

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	3, 964, 441	17, 402	2, 444, 206	40, 040	2, 770, 000	3, 560
Boston	539, 038	....	332, 849	....	418, 615	....
Philadelphia	730, 380	....	1, 066, 392	....	1, 236, 392	....
Cincinnati *	1, 177, 306	26, 984	1, 228, 245	37, 456	1, 084, 500	99, 668
Chicago	5, 251, 750	5, 032, 308	4, 240, 239	3, 366, 041	3, 247, 113	2, 404, 784
Saint Louis	1, 263, 486	87, 566	1, 158, 615	125, 604	1, 402, 669	219, 610
San Francisco	....	314, 559	....	465, 875	....	379, 636

* Commercial years ending August 31.

All grains, including flour, reduced to wheat-bushels.

	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
New York	89, 196, 326	45, 639, 358	92, 751, 196	58, 654, 024	105, 387, 283	73, 040, 236
Boston	16, 701, 934	....	17, 445, 018	....	17, 608, 250	....
Philadelphia	24, 117, 150	....	24, 949, 157	....	24, 625, 383	....
Baltimore	19, 431, 499	....	19, 070, 017	....	24, 699, 250	....
Cincinnati*	8, 264, 328	2, 990, 953	10, 123, 227	3, 964, 801	11, 395, 812	4, 626, 275
Chicago	89, 192, 849	84, 077, 888	100, 179, 101	92, 748, 837	95, 208, 041	84, 928, 572
Saint Louis	28, 895, 912	23, 885, 784	27, 244, 156	22, 505, 739	29, 757, 399	25, 253, 564

* Commercial years ending August 31.

LIVE-STOCK MARKETS.

NEW YORK.

The strong competition of several western cities, and the exceptionally high prices resulting from it, diverted a considerable portion of the usual live-stock trade of New York to other points, as is shown by the decreased receipt, during 1874, of all classes of farm-animals, except beeves, which show a small increase. Commercial journals complained of a gross abuse in railroad transportation. Several companies, by allowing special low freights to a few live-stock operators, had enabled them to practically control the market. The business of supplying the Eastern markets thus fell, to a considerable extent, into the hands of a speculating ring, which speedily exhibited a characteristic disregard of the public interests. The widest margin of profit was found in the transportation of cheap cattle, with which the market was overstocked. This system discouraged both the production and the consumption of superior beef, and partially demoralized the cattle trade. The roads in the Vanderbilt interest withdrew from this arrangement, and reduced the freights somewhat below actual running expenses, making them uniform. The other companies were forced to come to the same terms, which, during the latter half of 1874, seem to have been faithfully observed. Hence the transportation part of the problem has been satisfactorily arranged.

Cattle.—For wholesale slaughterers, as well as for retail butchers, the cattle trade of 1874 has been worse than for many years. There was a serious falling off, both in weight and quality of beeves, the reason for

which is given above. Many financial failures, some of them quite extensive, were chronicled during the year. Other embarrassments are also complained of.

The total number of beeves marketed during 1874 was 451,033, an increase of 11,289 over 1873. The monthly receipts were as follows: January, 31,649; February, 30,017; March, 36,635; April, 34,314; May, 34,958; June, 45,954; July, 35,360; August, 49,494; September, 39,257; October, 45,587; November, 44,263; December, 29,566. The weekly average was 8,673 against 8,456 in 1873. The Northwestern States considerably reduced their supplies to the New York market. Illinois furnished 228,320 against 233,460 in 1873; Ohio, 24,440, a decline of 10,884; Indiana, 12,639, an increase of 1,025; Michigan, 1,362, an increase of 199. West of the Mississippi, Missouri raised her supply from 25,098 to 30,164; Iowa from 4,173 to 6,210; Colorado from 488 to 12,388; Kansas declined from 2,792 to 1,120. Nebraska sends her first contribution of 271, and Montana hers of 176. Canada declines from 1,191 to 849. Texas raises her quota from 72,806 to 74,689, but Kentucky declines from 35,812 to 32,610. Of the States nearer the market, New York sends 13,600, an increase of 686; Pennsylvania, 388, an increase of 110; New Jersey, 291, an increase of 173; Maryland, 212, an increase of 152; Virginia, 14,118, an increase of 11,683; Tennessee, 286, an increase of 176. All the States on the list of 1873 are represented in 1874. The receipts of milch-cows amounted to 3,676, a loss of 1,025. Of veal calves, 104,719 were received, a decline of 11,296.

The range of prices of prime beeves per pound, at the close of the first week in each month, was as follows: January, 11¾ to 12½; February, 12 to 12½; March, 11¾ to 12½; April, 12 to 12½; May, 12 to 12¼; June, 11¾ to 12; July, 11¾ to 12; August, 12¼ to 12½; September, 12¼ to 12½; October, 12¼ to 12½; November, 12½ to 13½; December, 12½ to 12¾.

Cattle-products.—The receipts and shipments of cattle-products at New York during four years were as follows:

Articles.	1871.		1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Beef.............barrels.	164, 603	45, 277	58, 505	36, 054	39, 468	41, 455	64, 944	40, 816
Beef.............tierces.	....	80, 402	....	49, 085	....	57, 364	....	53, 212
Butter...........pounds.	....	7, 500, 347	....	4, 814, 497	....	3, 586, 103	....	4, 611, 896
Butter.........packages.	709, 473	....	680, 688	....	951, 932	....	980, 853	....
Cheese...........pounds.	....	70, 245, 881	....	67, 109, 248	....	88, 860, 349	....	94, 102, 050
Cheese.........packages.	1, 467, 633	....	1, 714, 210	....	2, 032, 289	....	2, 032, 240	....

Sheep.—The receipts of sheep during 1874 were 1,165,653, a decrease of 41,062 from those of 1873. The same adverse influences which embarrassed the cattle-trade were noted here also. Wholesale prices were too high for a living margin of profits, resulting in great losses in this branch of the trade. The average prices of prime sheep at the close of the first week in each month were as follows: January, 7½ cents per pound; February, 7¾; March, 7⅞; April, 8¾; May, 9; June, 6¾; July, 6; August, 6¼; September, 5¾; October, 6¼; November, 5½; December, 6½. The receipts of domestic wool were 76,110 bales, against 98,368 in 1873, and 77,693 in 1872.

Swine.—The receipts of swine amounted to 1,774,221, against 1,958,389

in 1873, a loss of 184,168. The quality and average weight per head of the animals received also show a great depreciation. The average prices of prime hogs at the close of the first week in each month were as follows: January, 5¾ cents per pound; February, 6⅞; March, 6¼; April, 5¾; May, 6; June, 6; July, 6¼; August, 7¼; September, 7; October, 6¾; November, 6½; December, 7¼. The average prices for dressed hogs ranged from 7¼ in May to 10 near the close of September.

Hog-products.—The receipts and shipments of leading hog-products during three years were as follows:

Articles.	1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
Pork .... packages.	145, 071	....	180, 163	....	152, 216	....
Pork .... barrels.	....	158, 194	....	197, 445	....	178, 070
Cut meats .... packages.	331, 288	....	562, 702	....	335, 798	....
Cut meats .... pounds.	....	209, 356, 144	....	319, 854, 801	....	222, 430, 348
Lard ....tierces and barrels.	355, 092	....	406, 579	....	386, 973	....
Lard .... kegs.	28, 021	....	31, 901	....	38, 088	....
Lard .... pounds.	....	173, 736, 353	....	184, 175, 568	....	139, 982, 979

Summary.—The following annual receipts of the above classes of farm-animals during seven years will show the remarkable growth of the live-stock trade of New York.

Animals.	1868.	1869.	1870.	1871.	1872.	1873.	1874.
Beeves	293, 101	325, 761	356, 026	380, 934	425, 275	442, 744	454, 033
Cows	5, 382	4, 836	5, 050	4, 646	5, 089	4, 701	3, 676
Calves	82, 935	93, 984	116, 457	121, 937	115, 130	116, 015	104, 719
Sheep	1, 400, 623	1, 479, 563	1, 463, 878	1, 331, 975	1, 179, 518	1, 206, 715	1, 165, 653
Swine	976, 511	901, 308	889, 625	1, 334, 492	1, 922, 727	1, 958, 389	1, 774, 221

The year 1874 was exceptional in so many points, that comparisons with former years should be made with caution. The ascendency of New York as a market for this as well as other branches of trade in farm-products is contested by Philadelphia and Baltimore, which have greatly enlarged their receipts, and it is probable that an increasing amount of the trade will be diverted from New York in years to come.

BOSTON.

Cattle-products.—The receipts and shipments of barreled beef, butter, and cheese for four years were as follows:

Articles.	1871.	1872.	1873.	1874.
RECEIPTS.				
Beef .... barrels..	27, 441	24, 951	31, 080	24, 376
Butter .... packages..	442, 316	461, 917	474, 067	521, 925
Cheese .... casks..	554	283	264	166
Cheese .... boxes..	202, 487	187, 484	158, 094	154, 127
Cheese .... tons..	131	129	72	80
SHIPMENTS.				
Beef, foreign .... barrels..	8, 114	7, 932	9, 466	7, 501
Beef, coastwise .... do....	1, 354	904	678	1, 013
Butter .... packages..	8, 594	6, 457	4, 334	10, 020
Cheese, foreign .... boxes..	8, 719	4, 726	17, 867	....
Cheese, foreign .... casks..	68	....	2	2
Cheese, coastwise .... boxes..	1, 639	1, 922	968	417

The prices of western mess-beef and extra for ten years ranged as follows: 1865, \$10 to \$26 per barrel; 1866, \$16 to \$24.50; 1867, \$15 to \$27; 1868, \$15.50 to \$25; 1869, \$10 to \$18; 1870, \$12 to \$19; 1871, \$10 to \$18; 1872, \$10 to \$14; 1873, \$8 to \$13; 1874, \$10.50 to \$16. Good to choice butter, during 1874, ranged from 28 to 55 cents per pound, and common from 15 to 50; cheese, common to prime, from 6 to 24.

Sheep-products.—The receipts of domestic wool have shown a remarkable increase, aggregating 272,724 bales, against 221,159 in 1873. Boston seems to be rapidly concentrating the wool-trade. It is estimated that three-quarters of the California clip finds its way to this market, with large proportions of Ohio, Pennsylvania, and northwestern clips. The facilities for this trade have been largely increased in the way of storage, handling, &c. During the year prices were very uniform, the range per pound being 42 to 65 cents for common western up to choice XX and picklock Pennsylvania, Ohio, and Virginia. The bulk of the sales was from 53 to 55 cents. In 1873 the extreme range was from 40 to 70. The imports declined, as compared with those of the fiscal year 1873, from 36,974,345 lbs. to 16,254,553. The high prices in foreign markets explain this decline of importation. The stock of domestic wool on hand at the close of the year was 12,738,400 pounds, against 7,882,000 pounds in 1873 and 3,662,000 pounds in 1872. The surplus of foreign wool in 1874 was 1,489,000 pounds, against 7,207,050 pounds in 1873, and 9,910,000 pounds in 1872.

Hog-products.—The receipts and shipments of hog-products for four years were as follows:

Articles.	1871.	1872.	1873.	1874.
RECEIPTS.				
Pork .... barrels..	39, 754	36, 731	38, 538	36, 526
Bacon .... boxes..	....	40, 332	74, 210	64, 524
Hams .... casks..	3, 988	10, 300	8, 289	9, 183
Hams .... barrels..	9, 961	5, 532	7, 411	3, 442
Lard .... tierces..	37, 081	29, 644	49, 760	2, 811
Lard .... kegs..	1, 665	754	2, 814	2, 759
SHIPMENTS.				
Bacon, foreign .... boxes..	63, 213	107, 408	226, 210	113, 408
Pork, foreign .... barrels..		27, 063	54, 536	33, 076
Pork, coastwise .... do...	4, 695	6, 005	2, 831	2, 490
Lard, foreign .... tierces..	21, 335	28, 515	47, 848	14, 199
Lard, coastwise .... do...	690	508	516	336
Lard, foreign .... kegs and pails..	14, 758	13, 377	22, 516	15, 228
Lard, coastwise .... do...	832	812	2, 384	1, 011

The prices of prime pork ranged from \$14 to \$22 per barrel during 1874, against \$11.50 to \$15.50 in 1873; mess-pork from \$16.50 to \$24.50, against \$14 to \$18.50 in 1873; lard, from 9½ to 16½ cents per pound, against 8 to 9¾ in 1873.

BUFFALO.

The receipts of farm-animals during 1874 embraced 504,594 cattle, 788,800 sheep, 1,431,800 hogs, and 21,936 horses; the shipments included 468,921 cattle, 687,000 sheep, 1,258,600 hogs, and 20,736 horses. The estimated value of the receipts of cattle, sheep, and hogs, for three years, was as follows: 1872, cattle, \$28,531,450; sheep, \$2,882,053; hogs, \$14,501,090; total, \$45,914, 593. 1873, cattle, \$26,889,056; sheep,

$4,003,700; hogs, $16,625,600; total, $47,517,756. 1874, cattle, $33,303,204; sheep, $3,997,380; hogs, $17,181,600; total, $54,482,184.

The receipts of cattle, sheep, and hogs for eighteen years were as follows:

Year.	Cattle.	Sheep.	Hogs.	Total.
1857	108, 203	307, 549	117, 168	532, 920
1858	134, 073	345, 731	92, 194	572, 968
1859	103, 337	189, 579	73, 619	366, 535
1860	156, 972	145, 354	85, 770	388, 096
1861	141, 929	238, 952	101, 679	482, 560
1862	129, 433	524, 976	105, 671	760, 020
1863	154, 789	474, 849	91, 128	720, 766
1864	135, 797	155, 959	301, 629	593, 385
1865	212, 829	207, 208	300, 014	720, 061
1866	275, 091	341, 560	552, 831	1, 169, 482
1867	257, 872	239, 943	607, 440	1, 105, 255
1868	265, 105	385, 815	470, 578	1, 121, 498
1869	347, 871	381, 450	894, 272	1, 528, 593
1870	388, 057	561, 447	739, 519	1, 644, 023
1871	384, 294	551, 131	886, 014	1, 821, 439
1872	379, 086	606, 748	1, 450, 109	2, 435, 943
1873	409, 738	733, 400	1, 662, 500	2, 805, 638
1874	504, 594	783, 800	1, 431, 800	2, 710, 194

The receipts of horses during seven years were as follows: 1868, 7,773; 1869, 12,038; 1870, 7,896; 1871, 13,319; 1872, 20,786; 1873, 28,336; 1874, 21,936.

PHILADELPHIA.

The annual receipts of live-stock for eleven years were as follows:

Year.	Beeves.	Cows.	Hogs.	Sheep.
1864	99, 850	7, 920	140, 400	295, 000
1865	96, 450	6, 540	136, 300	306, 000
1866	100, 500	10, 830	122, 500	512, 000
1867	90, 150	11, 464	175, 500	368, 500
1868	90, 400	9, 314	191, 900	417, 800
1869	99, 486	8, 085	176, 200	536, 500
1870	117, 903	8, 835	189, 500	682, 900
1871	125, 333	11, 150	199, 610	790, 200
1872	134, 850	12, 302	210, 376	749, 500
1873	165, 860	18, 405	344, 300	756, 750
1874	167, 130	18, 010	339, 590	757, 040

Live-stock products.—The receipts of butter during three years were as follows: 1872, 367,140 packages; 1873, 457,873 packages; 1874, 510,314 packages. Wool: 1872, 191,370 bales; 1873, 261,426 bales; 1874, 269,366 bales. Dressed hogs: 1872, 87,312; 1873, 86,874; 1874, 80,344. Lard: 1872, 192,360 packages; 1873, 251,834 packages; 1874, 284,770 packages. Eggs: 1872, 302,400 packages; 1873, 385,455 packages; 1874, 414,340 packages.

BALTIMORE.

Cattle.—The annual receipts of cattle for eight years were as follows: 1867, 55,713 head; 1868, 75,891; 1869, 91,000; 1870, 89,021; 1871, 88,386; 1872, 92,292; 1873, 94,664; 1874, 130,946. Of the receipts of 1874, 45,640 were taken by Baltimore butchers; 6,000 by the butchers of Washington, Annapolis, and other neighboring cities and towns; 22,000 were taken for stock-cattle in York, Carroll, and Baltimore Counties, Maryland; 20,000 were purchased by northern speculators. The

average price, per cental, during 1874, was about $5; 1873, $5.10; 1872, $5.20; 1871, $5.54. The monthly range of prices per cental on the 15th of each month of 1874 was as follows:

Month.	Common to fair.	Good to prime.	Average.
January	$3 00 to $4 00	$4 85 to $7 00	$5 12
February	3 50 to 4 37	5 00 to 7 00	5 25
March	3 50 to 4 50	5 50 to 7 25	5 50
April	3 50 to 4 75	5 25 to 6 37	6 00
May	4 50 to 5 00	5 37 to 7 25	6 25
June	4 50 to 5 25	6 12 to 6 90	5 87
July	4 37 to 5 00	5 50 to 6 62	4 62
August	3 50 to 4 25	5 50 to 6 50	4 50
September	3 25 to 3 75	5 00 to 6 20	4 00
October	3 50 to 4 25	5 12 to 6 50	4 50
November	3 25 to 4 25	5 50 to 6 75	4 37
December	3 00 to 4 25	5 37 to 6 75	4 12

Swine.—The trade in this class of farm-animals has declined considerably in volume during the last two years. The receipts for five years were as follows: 1870, 300,000; 1871, 307,436; 1872, 400,874; 1873, 392,734; 1874, 357,547. The late decline is attributed, by commercial authorities, to the high prices of hogs in the West. Prices have ruled high in the Baltimore market, especially during the last six months of 1874, as may be seen from the following table showing the comparative prices per cental of hogs on the 15th of each month of the past three years:

Month.	1872.	1873.	1874.
January	$6 00 to $7 25	$5 50 to $6 00	$7 50 to $7 87
February	6 50 to 7 26	6 25 to 6 85	7 37 to 8 75
March	6 50 to 7 25	7 00 to 7 75	7 00 to 7 87
April	6 00 to 6 75	7 50 to 8 50	7 50 to 8 37
May	5 50 to 6 50	7 00 to 7 37	7 00 to 8 00
June	5 75 to 6 25	6 25 to 7 25	7 50 to 8 25
July	6 00 to 6 50	6 75 to 7 25	8 50 to 9 25
August	6 50 to 7 25	7 25 to 7 50	8 00 to 10 50
September	7 25 to 7 50	6 75 to 7 25	8 00 to 10 50
October	6 50 to 7 00	6 00 to 7 00	9 50 to 9 75
November	5 75 to 6 50	5 25 to 6 00	8 25 to 9 00
December	5 00 to 5 50	7 00 to 7 50	9 00 to 9 50

The weight of receipts of live hogs at Baltimore, was 124,158,000 pounds in 1874, against 111,568,000 in 1873, and about 100,000,000 in 1872. All the receipts of 1874 were slaughtered in the city, but an unascertained portion of the products was exported. If these figures, taken from the statement of the Baltimore trade for 1874, by the Baltimore Journal of Commerce, are correct, the average weight of the receipts of that year was 347 pounds per head, against 284 pounds in 1872. This increase of 63 pounds per head is remarkable, considering the very great reduction in the average weight of hogs received at leading points in the Western States.

Hog products.—The heavy demand for pork, lard, &c. at the South caused prices, during 1874, to rule high. The foreign export trade in lard has increased very rapidly of late. The annual exports of six years were as follows: 1869, 1,864,140 pounds; 1870, 1,791,360; 1871, 4,876,760; 1872, 12,622,649; 1873, 11,596,004; 1874, 11,129,969. The price of tierce-lard rose from 9½ cents per pound at the beginning of the year to 14¾ in August, closing at 14 in December, the quotations representing the 15th of each month. Mess pork opened at $16.50 per barrel, rose to $22.50 in October, and closed at $21. The maximum of 1873 was $18.50 in May; of 1872, $17 in November.

CINCINNATI.

Cattle.—The cattle-trade of Cincinnati during the commercial year ending August 31, 1874, showed a very great enlargement; the receipts increased 33 per cent., and the shipments 49 per cent. This increase of business is attributed to the opening of the United Railroads Stock-yards. This enterprise, by affording facilities for the reception and marketing of animals, has attracted trade from a wider region of country and in larger volume. The drought prevailing in regions tributary to the Cincinnati market, by cutting off supplies of grain and grass, compelled the marketing of many cattle in inferior condition, but the general average is probably equal to that of the preceding year. The increased railroad communications with Texas brought a better class of animals from that region, the stock arriving in shorter time and in better condition. The demand both for consumption and shipment was better than during the previous year. Prices were affected by the panic, but the reaction was prompt, making the average equal to that of the previous year; lower-grade natives and Texans ruled lower, but the difference was made up in the better class of animals on sale.

The annual receipts, shipments, and average prices of prime beef-cattle during seventeen commercial years were as follows:

Year.	Receipts.	Shipments.	Annual average prices per cental of prime beeves.
1857–'58	29,566	17,115	$3 78
1858–'59	43,100	23,615	4 88
1859–'60	43,182	20,593	3 90
1860–'61	40,585	19,357	3 30
1861–'62	37,004	23,467	3 24
1862–'63	31,915	16,739	3 96
1863–'64	39,152	14,903	5 74
1864–'65	54,424	19,070	7 45
1865–'66	79,503	31,300	7 55
1866–'67	91,946	43,079	7 27½
1867–'68	87,459	43,315	7 27
1868–'69	107,813	40,185	5 62½
1869–'70	107,167	54,681	5 85
1870–'71	125,771	53,278	5 05 1-5
1871–'72	169,885	76,866	4 73¾
1872–'73	149,629	53,365	4 99 1-6
1873–'74	199,426	79,551	4 28

The comparative prices, per cental gross, of all grades of cattle at the close of each of the last four commercial years were as follows:

Grades.	1870–'71.	1871–'72.	1872–'73.	1873–'74.
Extra, shipping	$4 75 to $4 50	$5 50 to $6 00	$5 00 to	$5 75 to ....
Extra, butchers'	3 50 to 4 25	4 75 to 5 25	4 50 to $4 75	5 25 to $5 50
Fair	3 00 to 3 25	3 00 to 3 50	3 25 to 3 75	3 00 to 4 00
Common	2 25 to 2 50	2 50 to 3 00	2 00 to 2 50	1 60 to 2 75

Cattle products.—*Butter:* The butter-trade during the last commercial year was very satisfactory, and the quality of the receipts was constantly improving. The butter made by cheese-manufacturers was especially good. "The butter year" commenced in May with reduced stocks, and an active demand at good prices. As the season advanced large quantities were sent to New York for home consumption and foreign shipment. All grades commanded improved prices, but the lower grades showed the greatest advance on account of the high price

of lard. The great enhancement of values during the last two years is somewhat puzzling to market-men. Choice Central Ohio opened at 21 cents per pound, and gradually rose to 39 cents, with a subsequent decline on the approach of hot weather to 18 cents; the average was 27 cents, against 23.5 cents the previous year. The receipts and shipments are given very indefinitely in barrels, kegs, and firkins, in such a way as to render a comparison of actual quantities entirely impracticable. The annual average prices per pound of choice Central Ohio for eleven years were as follows: 1863–'64, 29 cents; 1864–'65, 35 cents; 1865–'66, 36⅛ cents; 1866–'67, 26½ cents; 1867–'68, 36½ cents; 1868–'69, 32⅞ cents; 1869–'70, 28⅓ cents; 1870–'71, 24⅝ cents; 1871–'72, 20⅗ cents; 1872–'73, 23⅕ cents; 1873–'74, 27 cents.

Cheese.—The cheese-trade of Cincinnati shows a decline of both receipts and shipments. The tendency of retail dealers to purchase directly of the manufacturer has become more marked and visible. The receipts of 1874 amounted to 181,685 boxes, against 207,847 boxes the previous year, a decline of 12½ per cent.; the shipments were 127,689 boxes, against 145,360 in the previous year, a decrease of 12 per cent. The improvement of quality since the inauguration of the factory system over large portions of the country is becoming more evident every year. Prices of factory-cheese opened in September at 13½, and rose gradually to their maximum, 17½, in the middle of March, but fell to 13 in August. The annual average prices per pound of factory-cheese for five commercial years were as follows: 1869–'70, 17 cents; 1870–'71, 13¾ cents; 1871–'72, 14½ cents; 1872–'73, 14½ cents; 1873–'74, 14¾ cents. The "cheese year" commences about May 1. It is to be desired that the quantities should be stated in pounds or in some definite multiple of pounds, as the term boxes represents a variable quantity.

Hides.—The receipts of the last commercial year were 161,192 pieces and 172,999 pounds, valued at $1,308,565, against 139,387 pieces and 211,863 pounds, worth $1,278,847, received during the previous year. The shipments of the last year were 103,293 pieces and 86,238 pounds, valued at $681,321, against 93,085 pieces and 190,107 pounds, valued at $734,913, shipped the previous year. These figures represent only what came by river, rail, and canal, and leave out of view the immense number supplied by the city butchers and neighboring farmers.

Sheep.—The receipts and shipments of sheep for eleven commercial years were as follows:

Years.	Receipts.	Shipments.
1863–'64	35,223	4,077
1864–'65	47,023	5,815
1865–'66	73,229	13,177
1866–'67	91,967	24,052
1867–'68	73,097	19,809
1868–'69	117,548	31,353
1869–'70	90,205	35,581
1870–'71	134,892	51,109
1871–'72	187,522	68,541
1872–'73	131,633	62,755
1873–'74	240,161	101,975

The increased trade of the last commercial year is attributed largely to the improved facilities for handling this kind of live stock. The enlargement of the receipts over 82 per cent., and of shipments, over 62 per cent., shows a large commercial demand, but a still larger for home consumption. It is remarkable that while a large portion of the cattle

receipts had deteriorated in quality from the previous year, sheep showed an improvement. Stock-men account for this upon the ground that sheep were fed upon the more nutritive short grasses. The demand was good all through the year, at fair prices. Opening at $3.50 per cental, prime sheep attained their maximum, $6.25 per cental, in the middle of May, but again receded to $3; average for the year $4.50, against $4.76¼ the previous year.

Sheep products.—Wool: The receipts and shipments of wool for eleven years were as follows:

Years.	Receipts.	Shipments.	Years.	Receipts.	Shipments.
	Bales.	*Bales.*		*Bales.*	*Bales.*
1863–'64	14,005	12,913	1869–'70	11,971	15,655
1864–'65	11,014	12,953	1870–'71	16,728	19,432
1865–'66	17,099	15,670	1871–'72	11,082	12,177
1866–'67	15,490	13,995	1872–'73	9,213	10,657
1867–'68	11,851	12,461	1873–'74	17,723	14,743
1868–'69	13,827	15,058			

NOTE.—Since 1855 the shipments have been reduced to bales averaging about 100 pounds.

At the opening of the last commercial year there was a good demand for wools, which the financial panic affected only partially. Stocks were small and in strong hands, which prevented a great demoralization in prices, though for the first few months business was dull. An active demand sprang up in January, and prices regained their former figures. The new clip came in during May from 2 to 5 cents per pound cheaper than its predecessor. New tub-washed commanded 45 cents per pound; unwashed manufacturing, 30 cents; unwashed combing, 38 cents. The new clip passed off very rapidly, being mostly in the hands of dealers and manufacturers, by the middle of July. Tub-washed wool rose to 52 cents in August, unwashed manufacturing to 34 cents, and unwashed combing to 40 cents. The manufacturing interest manifested a partiality for unwashed wool. Combing wools are in increased demand. The higher prices of the raw material were maintained in spite of declining prices for woolen fabrics, which greatly curtailed their production.

Swine.—The receipts, shipments, and values of live hogs at Cincinnati, during the last five commercial years, were as follows:

	1869–'70.	1870–'71.	1871–'72.	1872–'73.	1873–'74.
Receipts	484,894	650,935	1,015,885	1,119,482	1,121,707
Value of receipts	....	$10,414,960 00	$12,825,548 00	$12,182,762 00	$14,582,191 00
Value per head	....	$16 00	$12 09	$10 90	$13 00
Shipments	47,534	62,171	159,390	265,385	290,094
Value of shipments	....	$994,736 00	$2,012,299 00	$2,123,080 00	$3,191,034 00
Value per head	....	$16 00	$12 00	$8 00	$11 00

Packers entered upon their campaign of 1873–'74 with caution, as there were indications of another large hog-crop. The season opened at $3.75 to $3.95 per cental gross for good hogs, against $4.15 to $4.25 at the beginning of the previous year. At the close of December, 1873, prices had receded to $3.60 @ $3.67½, but rose again in February to $5 @ $6. The average paid by packers was $4.58, against $3.92 the previous year. After a season of much anxiety and vicissitude, the market closed at prices satisfactory to packers.

The total number of hogs packed in Cincinnati, with their average weight and yield of lard per head, during fourteen commercial years, were as follows:

Year.	Average weight per head.		Average yield of lard per head.		Number of hogs packed.	Average cost per cental.
	Gross pounds.	Net pounds.	All sorts—pounds.	Leaf and trimmings—pounds.		
1859-'60	....	189	....	23	434, 499	....
1860-'61	....	221. 2	....	28. 54	433, 799	....
1861-'62	....	224. 7	....	29. 22	474, 467	....
1862-'63	....	203	....	21. 85	608, 457	....
1863-'64	....	188. 88	....	23. 16	370, 623	....
1864-'65	....	201. 12	....	24. 20	350, 600	....
1865-'66	....	238. 54	....	32. 52	354, 079	....
1866-'67	....	232. 28	....	30. 5	462, 610	....
1867-'68	....	210. 18	....	25. 19	366, 831	....
1868-'69	....	214. 36	....	25. 16	356, 555	....
1869-'70	....	226. 33	....	27. 12	337, 330	....
1870-'71	298. 8	239. 07	42. 62	31. 2	481, 560	....
1871-'72	289. 2	231. 36	41. 02	29. 6	630, 301	$4 36. 4
1872-'73	304. 9	....	45. 67	....	626, 305	3 92. 3
1873-'74	280. 7	....	39. 7	....	581, 253	4 58. 2

The number of hogs packed in the last commercial year decreased 45,252, or 7.19 per cent. The total weight was 190,958,316 pounds, a decrease of 27,770,301 pounds, or 12½ per cent. The average gross weight per head was 280.75, a decrease of 24.14 pounds, or 8 per cent. The aggregate yield of lard was 23,076,785 pounds, a decrease of 5,528,092 pounds, or 19 per cent. The average yield of lard per head was 39.7 pounds, a decrease of 5.97 pounds, or 13 per cent. The aggregate cost of the hogs packed was $7,477,947, a decrease of $14,083, while the average cost per head rose from $3.93.3 to $4.58.2. The pork-product embraced 27,204 barrels of mess, a decrease of 5,397 barrels, or 16 per cent.; 941 barrels of prime mess, an increase of 463 barrels, or 97 per cent.; 75 barrels of clear pork, a decrease of 95 barrels, or 56 per cent.; 2,534 barrels of rump, a decrease of 40 barrels.

Hog-products.—The receipts during the last commercial year, of pork and bacon in all forms, were valued at $3,131,719, against $3,731,375 in 1872-'73; $3,682,572 in 1871-'72; and $2,628,931 in 1869-'70. The aggregate value of the shipments of the last commercial year was $14,-536,289, against $15,536,289 in 1872-'73; $12,981,151 in 1871-'72; and $9,114,278 in 1870-'71. The packages being of various sizes it is impossible to give the actual quantities of pork and bacon marketed at this point. The same is true of lard, of which the receipts of 1873-'74 were valued at $1,532,901, against $1,288,247 in 1872-'73; $1,277,355 in 1871-'72; and $1,557,989 in 1870-'71. The shipments of lard in 1873-'74 were worth $4,062,932, against $3,504,851 in 1872-'73; $3,531,327 in 1871-'72; and $5,563,564 in 1870-'71.

CHICAGO.

The live-stock receipts of Chicago during 1874 reached an aggregate value of $103,266,760, an increase of $11,945,598 over 1873. Of this sum, $1,758,800 represented the horse-trade; $35,868,455 the cattle-trade; $63,875,685 the hog-trade; $1,354,620 the sheep-trade. These figures justify the statement that Chicago has become the greatest live-stock market in the world.

Horses.—The receipts and shipments of horses for two years were as follows:

Month.	1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.
January	627	467	688	604
February	2,135	1,978	2,538	2,376
March	4,253	3,909	3,838	3,690
April	2,913	2,801	2,739	2,672
May	2,666	2,663	1,603	1,607
June	2,737	2,276	1,807	1,508
July	1,104	984	804	839
August	1,073	1,002	853	760
September	1,340	1,254	838	883
October	779	609	1,251	1,223
November	422	370	423	256
December	240	227	206	185
Total	20,289	18,540	17,588	16,608

The total value of the horses received in 1874, $1,758,800, against $2,028,902 in 1873, a decline of $270,102. The falling off from the high figures of the previous year is ascribed to the cessation of the extra demand for horses growing out of the ravages of epizooty two years ago. The losses from that cause having been measurably supplied, the trade has receded to its normal dimensions.

Cattle.—The monthly receipts and shipments of cattle during four years were as follows:

Month.	1871.		1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
January	30,708	16,639	44,990	33,047	50,520	30,564	59,438	44,771
February	43,299	28,782	41,087	36,146	45,019	35,509	52,775	43,719
March	44,752	39,578	53,170	43,705	63,836	56,477	72,542	59,935
April	48,144	43,522	58,393	52,474	84,249	68,531	77,346	66,733
May	59,217	49,455	71,700	67,039	81,602	80,261	77,373	72,993
June	52,564	44,637	63,449	52,335	85,380	68,818	89,274	68,723
July	50,041	39,754	58,439	41,928	73,207	54,505	65,118	48,299
August	50,583	36,007	64,463	47,211	67,731	49,726	73,308	50,541
September	53,175	38,528	66,744	43,179	65,394	44,301	73,761	45,854
October	37,981	22,759	64,957	34,388	63,845	34,162	85,193	50,161
November	42,781	20,378	55,884	32,468	37,712	23,351	65,530	37,643
December	29,805	21,393	40,799	26,105	42,933	27,976	52,308	33,552
Total	543,050	401,927	684,075	510,025	761,428	574,181	843,966	622,929

The above figures show an increase of receipts during 1874 of 82,538, and of shipments of 48,748, or 10¾ per cent. of the former and 8½ per cent. of the latter. The increase in receipts was larger than the increase of the previous year, but that of shipments was smaller, showing that an increased percentage of the receipts is either consumed in the city or made into beef for export. The gross value of the cattle received during 1874 was estimated at $35,868,455, against $35,264,260 in 1873 and $41,000,000 in 1872. The increase in gross value is in smaller proportion than in the number of receipts, showing a decline in the market value of beeves, which is still more perceptible by comparing the operations of 1874 with those of 1872. Prices of native cattle, exclusive of fancy holiday beeves, have ranged from $1.50 to $7.75 per cental; the range of 1873 was from $1.50 to $7. The year closed upon an active

and strong market, with a prospect that fat cattle would continue to demand high prices.

Cattle-products.—Beef: The receipts of barreled beef during 1874 were 27,885 barrels, against 7,158 in 1873, and 14,512 in 1872. The shipments of 1874 were 71,215 barrels, against 33,938 in 1873, and 39,911 in 1872.

Tallow: Receipts in 1874, 6,584,793 pounds; 1873, 8,406,823 pounds; 1872, 6,019,606 pounds. Shipments in 1874, 7,690,098 pounds; 1873, 11,574,813 pounds; 1872, 5,812,527 pounds.

Butter and cheese: The butter-trade shows a continued enlargement indicating a healthy growth of dairy industry in the Northwest. The receipts of 1874 were 25,573,309 pounds; 1873, 22,283,765 pounds; 1872, 14,574,777 pounds. The shipments of 1874 were 16,295,253 pounds; 1873, 12,851,303 pounds; 1872, 11,497,537 pounds. The market reports show higher average prices and readier sales in 1874 than previously. The improved quality of western butter is attracting the attention of buyers for foreign markets. During the summer and fall large purchases were made for direct shipment to Europe. The improved quality of western cheese is attested by the fact that the bulk of what is sent from this market branded "New York factory," is made in Illinois. Only experienced judges are able to detect the misrepresentation. The sale of eastern cheese is decreasing.

Hides: The receipts of 1874 were 49,830,057 pounds, against 36,885,-241 pounds in 1873, and 32,387,995 pounds in 1872. The shipments of 1874 were 47,089,243 pounds; 1873, 30,725,408 pounds; 1872, 28,959,292 pounds.

Sheep: The monthly receipts and shipments of sheep during four years were as follows:

Month.	1871.		1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
January	35,111	17,576	42,069	23,235	39,751	20,787	29,173	15,621
February	43,608	25,512	41,803	25,348	37,729	24,728	41,586	27,545
March	42,213	29,321	38,170	29,495	31,061	23,020	34,866	26,630
April	23,379	13,084	24,771	17,328	75,570	12,798	26,100	19,233
May	23,337	8,577	16,389	5,945	21,030	8,653	20,218	11,319
June	22,667	6,496	13,776	3,493	20,262	5,506	17,538	5,501
July	19,022	5,214	13,819	2,471	17,697	784	16,035	2,991
August	25,471	6,917	18,777	3,937	19,921	1,152	21,916	6,879
September	27,732	7,264	22,452	5,622	16,794	1,975	23,268	6,768
October	18,632	4,397	48,290	7,349	27,871	5,472	30,837	11,657
November	19,144	3,697	24,343	7,417	18,506	4,566	30,765	14,229
December	15,737	7,029	25,552	13,376	17,042	5,794	46,353	32,182
Total	317,053	135,088	310,211	145,016	291,734	115,235	338,655	180,555

The receipts of 1874 show an increase of 46,921, while the previous years show a decrease from the receipts of 1872. The total value of the receipts of 1874 is estimated at $1,354,620, against $875,000 in 1873, and $950,000 in 1872. The increase in value in 1874 was nearly 55 per cent., while in numbers received but 16 per cent., showing a rising market for this class of animals. A greater steadiness of prices, with only limited fluctuations, is the most prominent feature of the year's business. The extreme range of the market was from $1.50 per cental for "scalawags" to $8 for extra.

Sheep products—Wool.—The receipts of 1874 were 36,267,191 pounds; 1873, 34,486,858 pounds; 1872, 28,181,509 pounds. The shipments of 1874 were 38,117,931 pounds; 1873, 32,715,453 pounds; 1872, 27,720,089

pounds. The market was nearly stripped of old wool when the clip of 1874 came in. In spite of the great depression of the wool-manufacturing interest, the great bulk of the clip was speedily purchased by Eastern dealers, who also purchased from first hands a large amount that would otherwise have been marketed at Chicago. It is questioned whether there is wool enough left in the West to supply the western wool-factories till the next clip comes in. The western clip was smaller than that of 1873, but of good quality. Prices also reached a higher average.

Swine.—The monthly receipts and shipments of swine for four years were as follows:

Months.	1871.		1872.		1873.		1874.	
	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.	Receipts.	Shipments.
January	300, 697	26, 530	361, 935	78, 377	561, 245	95, 237	457, 088	146, 435
February	139, 342	47, 724	268, 236	104, 668	378, 760	163, 140	303, 341	163, 980
March	97, 058	75, 387	170, 785	144, 209	271, 626	224, 194	238, 728	202, 317
April	71, 632	63, 086	169, 149	145, 151	292, 903	225, 715	311, 945	245, 945
May	137, 521	111, 524	265, 259	196, 451	261, 361	217, 914	326, 838	265, 140
June	197, 499	166, 513	254, 714	206, 940	245, 860	189, 586	310, 072	238, 396
July	165, 831	134, 391	212, 030	172, 934	244, 550	201, 682	231, 416	183, 450
August	118, 975	98, 187	219, 406	198, 077	234, 145	188, 776	205, 904	147, 355
September	164, 749	125, 561	214, 728	186, 010	239, 512	191, 241	261, 123	168, 628
October	161, 212	131, 370	229, 304	175, 241	325, 716	196, 569	350, 812	242, 350
November	386, 766	113, 643	373, 963	132, 381	616, 301	156, 926	727, 407	203, 437
December	456, 831	67, 490	513, 114	95, 195	665, 771	146, 577	531, 705	119, 928
Total	2, 380, 083	1, 162, 286	3, 252, 623	1, 835, 594	4, 337, 750	2, 197, 557	4, 258, 379	2, 330, 361

The receipts fell off 79,371, but the increase of 1873 was so enormous that some decline might reasonably have been expected, as the States supplying this market are reported as short 1,000,000 of hogs, compared with 1873. The shipments, however, increased 132,804. The aggregate value of the receipts is estimated at $63,885,685, against $53,153,000 in 1873, and $33,500,000 in 1872. This shows a larger trade than for several years. The year opened with quotations of $4.75 to $5.60, and after several fluctuations rose to $6.50 and $7.75 at the end of November. The average weight of hogs received during the year was 218 pounds. The monthly average weight per head during three years was as follows:

Month.	1872.	1873.	1874.
	Pounds.	*Pounds.*	*Pounds.*
January	286⅝	289¼	252¾
February	263¾	269¾	211¼
March	227¾	221⅛	201¾
April	225⅝	213	197½
May	223	217¾	199¾
June	227⅛	230	206 7-10
July	234	231¼	207 9-10
August	233⅜	235⅛	208¾
September	257⅝	241 3-5	209¾
October	264¼	252¼	221¼
November	272	267¾	244
December	283¾	270¾	253½

During 1874 each monthly average shows a decrease from the previous year, ranging from 15½ pounds in April to 58½ pounds in February. The average decrease for the year was 27 pounds, creating a deficiency of 114,976,233 pounds, equal to the aggregate weight of 527,413 hogs, of the standard of 1874.

Swine products.—The total number of hogs packed in 1874 was 2,040,500, against 2,650,000 in 1873, and 1,203,000 in 1872.

Pork.—Receipts of 1874, 40,381 barrels; 1873, 43,758; 1872, 121,023. Shipments of 1874, 233,764 barrels; 1873, 191,144; 1872, 208,664. These figures show an increasing proportion of hogs received packed in the city. Prices rose from $14.30 to $14.40 per barrel at the beginning of the year, with some fluctuations, to $24.50 in September, but receded subsequently to $17.50.

Lard.—Receipts of 1874, 21,896,420 pounds; 1873, 26,571,425; 1872, 19,911,797. Shipments of 1874, 81,893,387 pounds; 1873, 89,847,680; 1872, 86,040,785. Prices rose from $8.40 @ $8.50 per cental, at the beginning of the year, to $14.75, closing at $13.10.

Cut-meats.—Receipts of 1874, 49,226,300 pounds; 1873, 53,782,954; 1872, 48,256,615. Shipments of 1874, 270,528,435 pounds; 1873, 342,986,021; 1872, 245,288,404.

Summary.—The annual receipts of cattle, hogs, and sheep during nine years since the establishment of the Union Stock-Yards were as follows:

Year.	Cattle.	Hogs.	Sheep.	Total.
1866	392, 604	933, 233	209, 420	1, 535, 257
1867	327, 650	1, 606, 680	180, 888	2, 115, 227
1868	324, 524	1, 706, 782	270, 875	2, 302, 181
1869	403, 102	1, 661, 869	340, 072	2, 405, 043
1870	532, 964	1, 693, 158	349, 855	2, 575, 977
1871	543, 050	2, 380, 083	317, 053	3, 240, 186
1872	684, 075	3, 252, 623	310, 211	4, 246, 909
1873	761, 428	4, 337, 750	291, 734	5, 390, 912
1874	813, 966	4, 258, 379	338, 645	5, 440, 990

SAINT LOUIS.

Cattle.—The cattle-trade of Saint Louis exhibits a large increase over last year, the receipts amounting to 260,925 head, and the shipments to 276,771 head. The annual receipts for the last ten calendar years were as follows: 1865, 94,307; 1866, 103,259; 1867, 74,746; 1868, 115,352; 1869, 124,565; 1870, 201,422; 1871, 199,527; 1872, 263,404; 1873, 280,773; 1874, 360,925.

The highest and lowest prices of all grades, for each month of the last four years, were as follows:

Months.	1871.	1872.	1873.	1874.*
January	$2 50 to $6 25	$2 25 to $5 50	$1 50 to $6 00	$1 50 to $6 50
February	2 50 to 6 50	3 25 to 5 75	1 50 to 6 00	1 50 to 6 25
March	2 75 to 6 50	3 50 to 6 75	1 50 to 6 37½	1 75 to 6 00
April	2 75 to 6 50	3 50 to 6 75	1 75 to 6 62½	2 00 to 6 25
May	2 62½ to 6 60	4 37½ to 6 50	2 00 to 6 12½	2 75 to 6 00
June	3 00 to 6 75	2 50 to 6 50	1 75 to 6 00	2 00 to 6 25
July	2 00 to 5 00	1 75 to 6 50	1 75 to 5 60	1 25 to 6 25
August	1 75 to 5 00	1 75 to 6 25	1 75 to 6 50	2 00 to 6 00
September	1 25 to 4 75	1 75 to 5 75	1 50 to 5 30	1 90 to 5 75
October	1 50 to 4 50	1 25 to 6 00	1 40 to 5 00	1 75 to 5 75
November	2 25 to 5 00	1 50 to 6 00	1 25 to 5 00	1 00 to 5 50
December	1 50 to 4 75	1 37½ to 5 75	1 25 to 5 00	1 75 to 5 75

* The prices of 1874 represent only the first of the month; those of the other years are the maxima and minima for the whole month.

Cattle products—Butter.—The total receipts for 1874 amounted to 74,937 packages, against 64,607 in 1873, and 51,259 in 1872. It is to be regretted that no accurate records of the trade are kept by any commercial authority which would enable us to determine the receipts and shipments in pounds. The term "packages" has no statistical value,

as it represents no definite quantity. The only general statement that can be hazarded is that the trade is rapidly increasing, though we are unable to state the rate of increase, a point very desirable in the statistical study of our agricultural resources. Prices ranged a little higher in 1874 than the previous year, the quotations for prime to choice being from 20 to 42 cents per pound, against 14 to 40 cents in 1873. In 1874 the minimum and maximum were in June and March, respectively; in 1873 they were in June and April.

Cheese.—The receipts of cheese during 1874 were 80,579 boxes, against 58,790 in 1873, and 84,345 in 1872. This branch of trade has steadily increased from domestic sources of supply during the past year. The large area of fine dairy lands in Missouri is being brought into requisition to supply the Saint Louis market, a movement stimulated, doubtless, by the short receipts of Eastern cheese in 1873. The lack of a common unit of quantity is likewise felt in stating the volume of the cheese-trade. If the receipts could be stated in pounds, it would greatly facilitate the aims of statistical inquiry. The prices of Ohio factory ranged from 12 cents per pound in July and August to 17 cents in February, March, and April; choice New York factory from 12¼ in August to 17½ in February and March; English dairy from 16 cents in October to 20 cents in April and May.

Beef.—Mess rose from $13 in January to $15 in August, September, October, and November.

Sheep.—The trade in sheep increased 33 per cent. during 1874, the receipts being 114,913, and the shipments 35,483. The annual receipts for ten years were as follows: 1865, 52,133; 1866, 64,047; 1867, 62,974; 1868, 79,315; 1869, 96,326; 1870, 94,477; 1871, 118,899; 1872, 115,904; 1873, 86,370; 1874, 114,913.

The prices per cental at the beginning of each month of 1874 were as follows: January, $3.75 to $5; February, $4.50; March, $5; April, $2.50 to $5.60; May, $4.25 to $6.10; June, $4 to $6; July, $2.50 to $6; August, $2.50 to $6; September, $2 to $4.25; October, $2.25 to $4.25; November, $2.50 to $4; December, $2.25 to $3.

Sheep products—Wool.—The receipts of wool during 1874 amounted to 4,963,417 pounds, against 3,956,212 pounds in 1873. Prices were well sustained during the year. The production is steadily increasing. Complaint is made of lack of home facilities for storage, compelling dealers to ship eastward at unfavorable times and subject to high rates of commission. The prices of unwashed medium reached their maximum, 36 cents per pound, in October, and their minimum, 29 cents, in April; unwashed combing 39 cents in July, August, and September, and 33 cents during the first five months; choice fleece-washed rose from 40 and 45 in January to 40 and 52 in September; choice tub-washed from 43 and 53 in May to 50 and 56 in October.

Swine.—The trade in live hogs largely increased during 1874, the receipts being 1,126,587 and the shipments 452,864. The annual receipts for ten years were as follows: 1865, 99,663; 1866, 217,622; 1867, 293,341; 1868, 301,569; 1869, 344,848; 1870, 810,850; 1871, 633,370; 1872, 759,076; 1873, 982,463; 1874, 1,126,587. The highest and lowest prices per cental at the beginning of each month of 1874 were as follows: January, $2.81 to $5.37½; February, $4.90 to $5.65; March, $4.90 to $5.30; April, — to $5.25; May, $4.50 to $5.45; June, $4.80 to $5.60; July, $5 to $6; August, $5.50 to $7.25; September, $4 to $7.50; October, $4.50 to $7.25; November, $3.25 to $6.25; December, $5.50 to $7.50.

Swine products.—It is impossible to state the volume of the trade in swine products, for the reason alleged in the case of other animal products—the lack of a common unit of measurement. Pork receipts for 1874

embraced 59,948 barrels, 8,978 tierces, and 1,201,029 pieces, against 57,512 barrels, 7,993 casks and tierces, and 1,588,916 pieces in 1873. Of bacon there were received in 1874 4,530 casks, 6,353 boxes, and 124,451 pieces, against 10,411 tierces, 5,978 packages, and 110,422 pieces in 1873. Of lard the receipts of 1874 embraced 20,522 tierces and 6,843 packages, against 22,948 tierces, 6,110 barrels, and 11,714 packages. Prices advanced during 1874 to a point at which it appeared impossible to maintain them, and there was general expectation of a decline. Prime mess pork opened in January at $14.50 to $15 per barrel, and culminated during the second week in December at $19.12 to $20.25, with a small decline toward the close of the year. Standard opened in January at $14.75 to $15, and reached its maximum, $24 to $25.50, in the third week of September; prime lard at the beginning of the year was quoted at 8¾ cents per pound; its maximum, 15¼ to 15½, was attained in the middle of September. Of bacon, packed shoulders ranged from 6½ cents per pound at the close of February to 11¼ during the third week of September; clear rib from 8½ to 14; clear sides from 8¾ to 17. Of dry salt meats, packed shoulders varied from 5¾ to 10¼; rib sides from 7¾ to 15¼; clear sides from 7¾ to 15½.

Horses and mules.—Saint Louis is the only general market in which the prices of horses and mules are regularly reported. The receipts of both classes of animals during 1874 were 27,165, and the shipments 30,018. The prices of plug horses varied from $20 to $75 per head; street-car horses, $55 to $125; good work-horses, $80 to 120; driving animals, $90 to $200; heavy-draught horses, $115 to $200; mules, $50 to $250.

PORK-PACKING.

PORK-PACKING IN THE WEST.

The record of the Cincinnati Price Current shows the number of hogs packed in the West during the last twenty-five packing seasons, as follows: 1849–'50, 1,652,220; 1850–'51, 1,332,867; 1851–'52, 1,182,846; 1852–'53, 2,201,110; 1853–'54, 2,534,770; 1854–'55, 2,124,404; 1855–'56, 2,489,502; 1856–'57, 1,818,486; 1857–'58, 2,210,778; 1858–'59, 2,465,552; 1859–'60, 2,350,822; 1860–'61, 2,155,702; 1861–'62, 2,893,666; 1862–'63, 4,069,520; 1863–'64, 3,261,105; 1864–'65, 2,422,779; 1865–'66, 1,785,955; 1866–'67, 2,490,791; 1867–'68, 2,781,084; 1868–'69, 2,499,873; 1869–'70, 2,635,312; 1870–'71, 3,695,251; 1871–'72, 4,831,558; 1872–'73, 5,410,314; 1873–'74, 5,466,200; 1874–'75, 5,566,266.

The following table shows the number packed in the different States of the West and Northwest during the last three packing seasons:

States.	1872–'73.	1873–'74.	1874–'75.
Ohio	885, 827	906, 804	870, 971
Indiana	610, 966	715, 703	666, 575
Illinois	1, 834, 611	1, 887, 328	2, 113, 845
Iowa	325, 417	369, 278	426, 258
Missouri	894, 334	746, 366	707, 310
Kansas	40, 885	64, 037	49, 536
Wisconsin	324, 072	333, 514	269, 468
Minnesota	24, 550	32, 700	20, 950
Nebraska	20, 220	29, 085	26, 950
Kentucky	322, 456	257, 259	308, 068
Tennessee	39, 300	26, 577	22, 639
Michigan	49, 306	71, 549	62, 836
Miscellaneous*	28, 450	26, 000	20, 820
Total	5, 410, 314	5, 466, 200	5, 566, 226
Increase	....	55, 886	100, 026

* Including Pittsburgh, Pa., and a few points in the Southern States.

The average net weight per head and the average yield of lard per head in the same States, during the last three packing seasons, were as follows:

States.	Average net weight per head.			Average yield of lard per head.		
	1872–'73.	1873–'74.	1874–'75.	1872–'73.	1873–'74.	1874–'75.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Ohio	242.51	233.49	222.73	43.85	39.04	39.66
Indiana	230.25	207.22	208.80	33.89	29.66	29.83
Illinois	239.21	219.02	213.76	43.21	37.23	36.66
Iowa	229.55	204.67	198.67	37.44	33.88	33.52
Missouri	214.12	207.01	189.74	36.03	33.86	29.19
Kansas	244.18	220.64	171.63	37.50	35.83	25.43
Wisconsin	230.45	210.89	212.48	39.55	30.50	31.63
Minnesota	227.27	229.36	237.46	39.36	36.41	29.83
Nebraska	246.71	214.65	193.36	39.70	34.59	26.[illegible]
Kentucky	225.84	213.87	209.60	39.78	29.66	29.79
Tennessee	207.11	200.42	192.39	31.21	34.16	29.20
Michigan	237.94	234.02	234.27	38.95	38.26	35.15
Miscellaneous*	237.94	207.94	197.08	38.95	31.03	28.27
General average	232.43	214.97	209.77	40.08	35.02	34.20

* Including Pittsburgh, Pa., and a few points in the Southern States.

The aggregate net weight and yield of lard during the last two seasons were as follows:

Packing seasons.	Net weight.	Yield of lard.
	Pounds.	*Pounds.*
1872–'73	1,257,519,283	216,845,385
1873–'74	1,175,126,971	191,444,035
Decrease of 1873–'74	82,392,312	25,401,350
1873–'74	1,175,126,971	191,444,035
1874–'75	1,167,639,457	190,380,607
Decrease of 1874–'75	7,487,514	1,063,428

The average cost of hogs per cental, during the last three packing-seasons, was as follows:

States.	1872–'73.	1873–'74.	1874–'75.
Ohio	$4 82.59	$5 57.24	$8 64.3
Indiana	4 43.96	5 29.63	8 14.96
Illinois	4 67.1	5 43.25	8 35.6
Iowa	4 31.29	5 19.03	8 87.58
Missouri	4 63.3	5 36.63	8 19.1
Kansas	4 01.1	4 77.58	7 59
Wisconsin	4 72.48	5 72.16	8 56.04
Minnesota	4 81	5 68.52	7 28.9
Nebraska	3 70	4 64.17	6 73.44
Kentucky	4 88	5 54.45	8 67.51
Tennessee	5 13.5	5 72.23	8 81
Michigan	4 94.2	5 54.30	8 15.88
Miscellaneous	4 94.2	5 88.10	8 64
General average	4 65.8	5 43.15	8 33.63

The number of hogs packed at six principal points, compared with the aggregate at all other points during the past three years, was as follows:

Packing points.	1872.	1873.	1874.
Chicago	1,425,079	1,520,204	1,690,348
Cincinnati	626,305	581,253	560,164
Saint Louis	538,000	463,793	462,246
Indianapolis	196,317	295,766	278,339
Milwaukee	303,500	294,054	236,596
Louisville	302,246	226,947	273,118
Total	3,391,447	3,382,017	3,500,811
Other points	2,018,867	2,084,363	2,065,415
Grand total	5,410,314	5,466,380	5,566,226
Per cent. of the six cities	62.68	61.87	62.89

The average number, net weight, and yield of lard per head of these six cities, during the packing-season of 1874–'75, were as follows:

Cities.	Number.	Average net weight per head.	Average yield of lard per head.
Chicago	1,690,348	212.42	37.30
Cincinnati	560,164	220.60	41.77
Saint Louis	462,246	192	30
Indianapolis	278,339	196	29.50
Louisville	273,118	209.27	29.87
Milwaukee	236,596	208.56	31.15
At the six cities	3,500,811	209.47	35.43
At other points	2,065,415	210.27	32.21
At all points	5,566,226	209.77	34.20

The increase in number during the season of 1874–'75 was 100,026, or 1.83 per cent. The increase of the season of 1873–'74 over its predecessor was 55,886, or 1.03 per cent. The decrease in net weight per head during 1874–'75 was 5.20 pounds, or 2.04 per cent.; the decrease in the aggregate weight was 7,487,514 pounds, or .63 per cent. The previous season of 1873–'74 showed a decrease of 17.46 pounds net weight per head, or 7½ per cent., and of 82,392,312 pounds of aggregate net weight, or 6.55 per cent. The average yield of lard per head in 1874–'75 showed a loss of .82 pounds, or 2.34 per cent., against a loss of 5.06 pounds per head, or 12.62 per cent., the previous year. The aggregate lard-product fell off 1,063,428, or .55 per cent., against a loss of 25,401,350 pounds, or 1.71 per cent., in 1873–'74. The lighter weight of hogs would indicate a greater loss in the yield of lard, but the higher price of this article caused a closer trimming of hams and shoulders and consequently a greater yield of lard. The cost per cental of hogs was $8.336, against $5.431 in 1873–'74, and $4.058 in 1872–'73; that is, the increase of the season lately past was 53½ per cent., against an increase of 16½ per cent. the previous season. The aggregate cost of the hogs packed during the past season was $97,338,626, an increase of $33,511,611, or 52½ per cent. The aggregate loss of weight in 1874–'75 was equivalent to 34,830 hogs of the standard of 1873–'74, but the loss of the latter year was much greater, amounting to 354,483 of the standard of 1872–'73.

From the above statements it appears that this great productive

interest within the last two seasons, has considerably fallen off from the product of 1872–'73, which embraced the largest aggregate weight of pork and lard ever secured in any one year in this country. A comparison of the records of the last ten years shows that the greatest average net weight per head—232.43 pounds—was realized in 1872–'73, slightly exceeding the average of 1866–'67, which was 232.14. The greatest average yield of lard per head was 41.52 pounds in 1865–'66; the yield in 1870–'71 was 40.19 pounds, and in 1872–'73, 40.08 pounds. Every other year of the ten averaged less than 40 pounds.

The net weight per head, the aggregate weight of the hogs packed, the average yield of lard per head, and the aggregate product of lard for the last ten packing-seasons, were as follows:

Seasons.	Net weight per head.	Ag'regate weight of all hogs pack'd.	Yield of lard per head.	Aggregate yield of lard.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1865–'66	231. 3	413, 091, 391	41. 52	74, 152, 851
1866–'67	232. 14	588, 212, 222	39. 66	98, 801, 376
1867–'68	201	558, 997, 884	29	80, 651, 436
1868–'69	206. 75	516, 848, 742	32. 33	80, 829, 227
1869–'70	205. 75	542, 215, 444	31. 84	83, 908, 334
1870–'71	230. 14	850, 425, 065	40. 19	148, 512, 317
1871–'72	227. 62	1, 099, 783, 385	34. 54	188, 603, 317
1872–'73	232. 43	1, 257, 519, 283	40. 08	216, 845, 385
1873–'74	214. 97	1, 175, 126, 971	35. 02	191, 444, 035
1874–'75	209. 77	1, 167, 639, 457	34. 20	190, 380, 607

Of the States represented in the above tables, Illinois reports an increase in the number of hogs packed of 226,517; Iowa, of 58,980; Kentucky, of 50,809. All the other States report a decrease. In Kentucky the only considerable packing-point is Louisville, which absorbs nearly all of the increase for the State. Many hogs from Indiana and Illinois are packed at this point. The short corn-crop of Missouri caused an exportation of stock-hogs from that State during last summer. In Wisconsin dressed hogs were sent to the pineries for consumption in larger numbers, reducing the amount of cut meats marketed at the packing points. In average net weight per head there is an increase in Indiana, Wisconsin, Minnesota, and Michigan, with a decline in all the other States. Minnesota shows the largest average, 237.46 pounds; next stands Michigan, 234.27 pounds. The greatest decline is found in Kansas, which averages 171.63 pounds, against 220.64 pounds last season. In yield of lard per head Ohio stands first, averaging 39.66 pounds; a slight increase over the previous season. Next Michigan reports 35.15 pounds, against 38.26 the previous year. Kansas shows the minimum yield, 25.43 pounds, against 35.83 pounds the previous year. The grasshopper devastations account for the low averages in Kansas and Nebraska. The average price per cental was highest in Iowa, $8.875, and next highest in Tennessee, $8.81. The lowest price, $6.734, was in Nebraska. The greatest increase of prices, 71 per cent., was in Iowa; the smallest increase, 28 per cent., was in Minnesota. The average increase of the whole was 55 per cent.

Last year the six principal packing-points declined somewhat in their percentage of the total number reported. This year they have not only recovered their ground, but have also exceeded their percentage for 1872–'73. A few new points are added to the list this year, the operations of which amounted to 52,989 head. Chicago increased her numbers 170,144, and Louisville 46,171 head. The other points show some decline, though Saint Louis reports but a slight decrease.

The product of barreled pork of the last season was as follows: Mess pork 452,731 barrels, against 423,844 barrels the previous year; prime mess, 49,120 barrels, against 39,564 barrels; clear, 11,681 barrels, against 5,143 barrels; rumps, 20,628 barrels, against 20,019 barrels; other sorts, 35,308, against 15,000 barrels; total 569,468 barrels in 1874-'75, against 503,570 barrels the previous season.

SUMMER-PACKING.

The number of hogs packed during the summer season, from March 1 to November 1, is increasing. In 1874 the aggregate summer-packings reported in Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, Minnesota, Michigan, West Virginia, and Milwaukee amounted to 1,200,444 hogs, against 1,062,916 in 1873; showing an increase of 137,528, or 13 per cent. The points showing the largest increase were Cincinnati, Chicago, Saint Louis, Cedar Rapids (Iowa,) Canton (Illinois,) and Milwaukee. Indianapolis exhibits a considerable decline, as also do Keokuk, Iowa, Kansas City, Missouri, Quincy, Illinois, and several other points.

PORK-PACKING ON THE PACIFIC SLOPE.

The Cincinnati Price Current, through inquiries directed to numerous correspondents on the Pacific coast, has discovered a considerable enterprise in pork-packing in that region, which promises to increase in the future and to supersede a large portion of the importations from the States east of the Rocky Mountains. At San Francisco, during 1874, about 230,000 head were packed, and in other parts of the State about 160,000 more, making 390,000 in California. It is estimated that Oregon packed about 60,000, making the total number for the Pacific slope about 450,000. The weight of California hogs, however, is very small, those packed at San Francisco averaging only 115 pounds net, but the quality is considered superior to that of eastern hogs. They are fattened on wheat, barley, and corn. The abundance and cheapness of grain has given rise to expectations of a greatly-increased hog-crop the coming year. In San Francisco the most active packing operations are during the latter half of the year, when it is practicable to secure a temperature as low as 55° Fahrenheit. In the foot-hills of the Sierra Nevada the packing is generally done during the winter, as the summer temperature is unmanageable.

PORK-PACKING IN THE SEABOARD CITIES.

From the meager reports received it appears that the number of hogs packed in the eastern cities showed some decline during the past year.

New York.—The number and average weight per head of the hogs received at New York during the two years ending March 1, 1875, were as follows:

	Live hogs.	Dressed hogs.	Total.
1873-'74, winter packing	703,000	121,000	824,000
1873-'74, summer packing	1,251,000	7,000	1,238,000
Total for the year	1,954,000	128,000	2,062,000
1874-'75, winter packing	682,000	48,000	730,000
1874-'75, summer packing	1,005,000	12,000	1,107,000
Total for the year	1,687,000	60,000	1,837,000

The receipts at New York during five calendar years were as follows: 1870, 862,335; 1871, 1,311,052; 1872, 1,953,571; 1873, 1,961,578; 1874, 1,786,681.

Boston.—The receipts of live and dressed hogs at Boston during the two years ending March 1, 1875, were as follows:

	Live hogs.	Dressed hogs.	Total.
1873-'74, summer	475,795	6,112	481,907
1873-'74, winter	422,418	54,465	476,883
Total	898,213	60,577	958,790
1874-'75, summer	364,172	8,273	372,445
1874-'75, winter	132,693	90,948	223,641
Total	496,865	99,221	596,086

The receipts of the last three calendar years were as follows:

Year.	Live hogs.	Dressed hogs.	Total.
1872	593,000	70,000	663,000
1873	838,000	80,000	918,000
1874	525,000	88,000	613,000

The high prices in the West seriously crippled packing operations during the winter-packing season just closed. The receipts of 1874 were 313,000 short of those of 1873.

Baltimore.—The receipts of live hogs for five calendar years were as follows: 1870, 300,000; 1871, 307,436; 1872, 400,874; 1873, 392,734; 1874; 357,547. Hogs are usually slaughtered for city consumption of fresh pork. The Baltimore packers generally have their packing-houses at some point in the West, where their operations swell the aggregates of that region.

Philadelphia.—The receipts of live and dressed hogs during three calendar years were as follows:

Year.	Live hogs.	Dressed hogs.	Total.
1872	210,376	87,312	297,688
1873	344,300	86,874	431,174
1874	339,590	80,344	419,934

The number packed for market is small, the hogs being generally slaughtered for local consumption.

Receipts at the four cities.—The comparative receipts of live hogs at the four cities above named during three calendar years were as follows:

Cities.	1872.	1873.	1874.
	593,000	838,000	587,000
	1,953,000	1,961,000	1,936,000
	400,000	392,000	357,000
	210,000	344,000	339,000
	3,156,000	3,535,000	3,219,000

IMMIGRATION.

The net immigration of the past eight years, according to the records of the Treasury Department, is 2,792,383 persons, making an average of 349,048 per annum. The years 1867, 1868, 1871, 1874, show receipts less than this average. The largest immigration was in 1872; the smallest in 1874, which is classified as follows:

<table>
<tr><th></th><th>First quarter.</th><th>Second quarter.</th><th>Third quarter.</th><th>Fourth quarter.</th><th>Total.</th></tr>
<tr><td>Professional occupations</td><td>373</td><td>741</td><td>747</td><td>604</td><td>2,465</td></tr>
<tr><td>Skilled</td><td>4,760</td><td>11,166</td><td>9,834</td><td>6,722</td><td>32,482</td></tr>
<tr><td>Miscellaneous</td><td>12,374</td><td>48,384</td><td>25,451</td><td>15,109</td><td>101,318</td></tr>
<tr><td>Occupations not stated *</td><td>488</td><td rowspan="2">52,018</td><td>504</td><td>618</td><td rowspan="2">124,549</td></tr>
<tr><td>Without occupation *</td><td>9,837</td><td>37,559</td><td>23,525</td></tr>
<tr><td>Total</td><td>27,832</td><td>112,309</td><td>74,095</td><td>46,578</td><td>260,814</td></tr>
</table>

Sources.	FIRST QUARTER.			SECOND QUARTER.			TOTAL FOR THE YEAR.	
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.
England	2,797	1,400	4,197	9,377	5,831	15,208	26,129	17,267
Ireland	1,505	826	2,331	13,739	13,265	27,004	23,738	23,950
Scotland	594	263	857	2,382	1,310	3,692	5,443	3,322
Germany	3,608	2,064	5,672	13,737	10,740	24,477	32,402	24,525
Austria	211	111	322	1,844	1,654	3,498	3,680	3,211
Sweden	147	102	249	1,095	693	1,788	2,529	1,807
Norway	226	145	367	1,896	1,427	3,323	3,793	2,788
Denmark	81	34	115	987	626	1,613	1,863	1,325
Netherlands	97	65	162	447	343	790	883	650
Switzerland	179	88	267	699	522	1,221	1,448	988
France	1,443	653	2,096	1,669	990	2,659	5,612	3,129
Italy	1,054	301	1,355	2,583	429	3,012	4,702	1,085
Russia	117	51	168	603	384	987	4,110	3,337
Poland	176	96	272	275	182	457	860	589
China	1,153	66	1,219	9,168	20	9,188	16,340	311
British America	5,357	1,740	7,097	6,856	3,569	10,425	20,537	10,059
Other countries	788	294	1,082	2,140	827	2,967	5,867	2,535
Total	19,533	8,299	27,832	69,497	42,812	112,309	159,936	100,878

Sources.	THIRD QUARTER.			FOURTH QUARTER.			Total for the year.
	Males.	Females.	Total.	Males.	Females.	Total.	
England	9,279	6,670	15,949	4,676	3,366	8,042	43,396
Ireland	5,684	6,569	12,253	2,810	3,290	6,100	47,688
Scotland	1,640	1,211	2,851	827	538	1,365	8,765
Germany	8,700	6,459	15,159	6,357	5,262	11,619	56,927
Austria	777	635	1,412	848	811	1,659	6,891
Sweden	787	698	1,485	500	314	814	4,336
Norway	1,113	780	1,893	558	436	994	6,577
Denmark	524	514	1,038	371	151	422	3,168
Netherlands	191	144	335	148	98	246	1,533
Switzerland	261	187	448	309	191	500	2,436
France	1,233	719	1,952	1,267	767	2,034	8,741
Italy	531	180	711	534	175	709	5,787
Russia	2,202	1,977	4,179	1,188	925	2,113	7,447
Poland	236	180	416	173	131	304	1,449
China	4,065	180	4,245	1,954	45	1,999	16,651
British America	4,494	2,566	7,060	3,830	2,184	6,014	30,596
Other countries	1,841	868	2,709	1,098	546	1,644	8,402
Total	43,558	30,537	74,095	27,348	19,230	46,578	260,814

* Mainly women and children.

MARKET-PRICES OF FARM-

The following quotations represent the state of the markt,

Products.	January.	February.	March.	April.	May.
NEW YORK.					
Flour, superfine State . bbl	$5 60 to $6 00	$5 65 to $6 20	$5 70 to $6 10	$5 60 to $6 15	$5 85 to $6 05
extra State	6 55 to 7 30	6 45 to 7 00	6 40 to 6 80	6 35 to 6 70	6 30 to 6 75
superfine western	5 60 to 6 00	5 65 to 6 20	5 70 to 6 10	5 60 to 6 15	5 85 to 6 05
extra to choice western	6 50 to 11 00	6 35 to 11 00	6 30 to 11 00	6 25 to 11 00	6 15 to 11 00
southern shipping	6 85 to 8 00	6 70 to 7 75	6 60 to 7 55	6 40 to 7 25	6 40 to 7 30
southern family	8 05 to 11 00	7 80 to 11 00	7 60 to 11 00	7 30 to 11 00	7 35 to 11 00
Wheat. No. 1, spring . bush.	1 63 to 1 65	1 58 to 1 62	1 52 to 1 58	1 57 to 1 62½	1 61 to 1 65
No. 2, spring	1 58 to 1 61½	1 54 to 1 59	1 48 to 1 52	1 50 to 1 56½	1 52 to 1 58
winter, red, western	1 58 to 1 65	1 60 to 1 65	1 56 to 1 62	1 58 to 1 65	1 63 to 1 66
winter, amber, western	1 65 to 1 68	1 66 to 1 70	1 63 to 1 66	1 66 to 1 68	1 66 to 1 70
winter, white, western	1 70 to 1 95	1 60 to 1 93	1 60 to 1 85	1 50 to 1 90	1 55 to 1 87
Rye	1 00 to ——	1 05 to 1 10	98 to 1 02	98 to 1 03	—— to 1 13
Barley	1 55 to ——	1 80 to 2 10	—— to 2 00	1 85 to ——	—— to 1 50
Corn	78 to 85	81 to 90	76 to 80½	80 to 88	83 to 88
Oats	60 to 63	60 to 63	61 to 63½	56 to 63	63 to 68
Hay, first quality . . . . ton.	26 00 to 28 00	26 00 to 28 00	23 00 to 27 00	24 00 to 25 00	24 00 to 33 00
second quality	23 00 to 25 00	23 00 to 25 00	20 00 to 21 00	21 00 to 23 00	20 00 to 21 00
Beef, mess . . . . bbl.	8 75 to 11 00	8 50 to 11 00	10 50 to 11 00	10 00 to 11 50	10 00 to 12 00
extra mess	11 50 to 13 00	11 50 to 13 50	12 50 to 13 00	12 50 to 13 50	12 50 to 14 00
ork, mess	16 37½ to 16 50	16 00 to 16 25	15 75 to 15 80	—— to 16 75	16 90 to 17 05
extra prime	13 00 to ——	13 75 to ——	13 50 to ——	14 00 to 14 50	13 25 to 14 62½
prime mess	14 25 to 14 75	—— to 15 00	14 25 to 15 00	14 75 to 15 75	15 25 to 15 75
Lard . . . . lb.	8¾ to 9¼	9½ to 10	9¼ to 9⅜	9¼ to 10	10½ to 10¾
Butter, western	26 to 35	25 to 35	25 to 40	30 to 38	22 to 27
State dairy	33 to 45	32 to 47	36 to 55	35 to 45	28 to 38
Cheese, State factory	12 to 14¾	12½ to 15⅛	14½ to 17	15 to 16¾	15 to 17½
western factory	12 to 14½	12½ to 15½	14 to 16½	13 to 16	. . . .
Cotton, ordinary to good ordinary	13½ to 14¾	13 to 14¼	12⅜ to 14⅛	12⅝ to 15½	13⅞ to 16
low middling to good middling	15⅛ to 17¼	15 to 17½	15 to 17⅛	15⅝ to 18⅜	16⅜ to 19¼
Sugar, fair to good refining	7¼ to 7¾	7¼ to 7½	7⅛ to 7⅜	7½ to 7¾	7¾ to 8
prime refining	7½ to ——	8 to ——	7⅜ to 7⅞	7⅜ to 7½	8¼ to ——
Tobacco, lugs	6½ to 7¾	6½ to 8	6½ to 7½	4½ to 6¾	4½ to 6½
common to medium leaf	8 to 10	8 to 10	8 to 10	6½ to 8½	6 to 8½
Wool, American XXX and picklock	62 to 70	62 to 70	60 to 65	62 to 70	62 to 70
American X and XX	47 to 60	45 to 60	45 to 57½	45 to 60	45 to 60
American combing	52 to 60	52 to 60	52 to 60	52 to 60	52 to 60
pulled	45 to 52	25 to 52	25 to 50	25 to 33	25 to 50
California spring	18 to 35	18 to 35	18 to 52	13 to 35	19 to 35
California fall	13 to 29	20 to 29	19 to 28	20 to 27	20 to 27
Texas	15 to 35	15 to 35	18 to 36	23 to 35	. . . .
PHILADELPHIA.					
Flour, superfine . . . . bbl	4 50 to 5 50	5 25 to 5 75	5 00 to 5 75	5 00 to 5 35	5 00 to 5 50
Pennsylvania extra	6 75 to ——	6 00 to 6 50	6 00 to 7 00	—— to 6 37½	5 75 to 6 50
Pennsylvania family and fancy	7 00 to 8 00	8 12½ to 8 50	7 50 to 8 12½	7 50 to 8 00	6 75 to 8 25
western extra	6 00 to 6 75	6 00 to 8 25	6 00 to 7 75	6 37½ to 7 50	6 75 to 7 00
western family	6 75 to 8 00	8 50 to 10 50	8 37½ to 10 25	7 50 to 8 75	7 50 to 8 50
Wheat, red, winter . bush	1 47 to 1 63	1 56 to 1 74	1 60 to 1 71	1 58 to 1 64	1 50 to 1 63
amber winter	1 68 to 1 70	1 65 to 1 78	1 70 to 1 73	1 70 to 1 76	1 50 to 1 80
white winter	1 73 to 1 85	1 60 to 1 85	1 78 to 1 85	1 85 to 1 92	1 90 to ——
spring	1 55 to 1 59	1 60 to 1 65	1 50 to 1 55	1 48 to 1 52	1 43 to ——
Rye	90 to 93	95 to 96	90 to 92	95 to ——	98 to 1 00
Barley	1 20 to 1 65	1 95 to 2 20	1 90 to 2 25	1 75 to 1 90	. . . .
Corn	70 to 85	76 to 86	72 to 76	81 to 84	84 to 90
Oats	52 to 58	55 to 65	57 to 65	58 to 65	62 to 65
Hay, fresh baled . . . . ton.	23 00 to 24 00	23 00 to 24 00	23 00 to 24 00	22 00 to 24 00	23 00 to 25 00
common to fair shipping	20 00 to 22 00	20 00 to 22 00	20 00 to 22 30	20 00 to 22 00	21 00 to 23 00
Beef, western mess . . bbl	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00
extra mess	9 00 to 12 00	9 00 to 12 00	9 00 to 12 00	9 00 to 12 00	9 00 to 12 00
Warthman's city family	16 00 to ——	16 00 to ——	15 50 to ——	16 00 to ——	16 00 to ——
rk, mess	16 50 to 17 00	16 50 to 16 75	16 00 to 16 50	16 50 to 17 00	17 00 to 17 25
prime mess	15 00 to ——	15 00 to ——	15 00 to ——	16 00 to ——	16 00 to ——
prime	13 00 to ——	13 00 to ——	13 00 to ——	14 50 to ——	14 15 to ——

PRODUCTS FOR 1874.

as nearly as practicable, at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$5 25 to $5 75	$5 00 to $5 50	$4 40 to $5 00	$4 45 to $5 00	$4 40 to $4 80	$4 00 to $4 55	$4 00 to $4 50
6 00 to 6 60	5 85 to 6 55	5 25 to 6 10	5 15 to 5 75	5 00 to 5 75	4 70 to 5 65	4 80 to 5 65
5 25 to 5 75	5 00 to 5 50	4 40 to 5 00	4 45 to 4 95	4 40 to 4 80	4 00 to 4 55	4 00 to 4 50
5 85 to 11 00	5 75 to 11 00	5 15 to 11 00	5 05 to 9 00	4 90 to 9 00	4 60 to 8 00	4 75 to 8 00
6 15 to 7 00	6 00 to 6 70	5 50 to 6 15	5 25 to 6 10	5 00 to 6 00	4 80 to 5 75	4 80 to 5 75
7 65 to 11 00	6 75 to 11 00	6 20 to 11 00	6 15 to 9 00	6 05 to 8 75	5 80 to 8 25	5 80 to 8 25
1 50 to 1 51	1 40 to 1 43½	1 30 to 1 36	1 20 to 1 23¼	1 21 to 1 27	1 09 to 1 17	1 18 to 1 25
1 45 to 1 48½	1 34 to 1 39	1 23 to 1 30	1 13 to 1 20	1 11½ to 1 20	1 02 to 1 14	1 11½ to 1 18
1 50 to 1 55	1 37 to 1 40	1 27 to 1 30	1 08 to 1 27	1 21 to 1 27	1 14 to —	1 18 to 1 28½
1 56 to 1 58	1 40 to 1 44	1 30 to 1 32	1 22 to 1 27	1 21 to 1 27	— to 1 23	1 18 to 1 28¼
1 50 to 1 75	1 42 to 1 60	1 35 to 1 55	1 25 to 1 45	1 30 to 1 42	1 25 to 1 36	1 30 to 1 40
1 04 to 1 13	1 10 to —	96 to 1 05	....	90 to 95	90 to —	94 to 97½
— to 1 80	....	....	1 90 to —	1 25 to —	1 45 to —	1 55 to —
76 to 81½	74 to 87	77 to 88	82 to 83½	96 to 1 00	77 to 92	87 to 92½
62 to 66	56 to 63	75 to 1 00	47 to 56	60 to 65	59 to 62	67 to 71
25 00 to 31 00	23 00 to 28 00	22 00 to 27 00	19 00 to 31 00	16 00 to 21 00	16 00 to 20 00	12 00 to 19 00
— to 23 00	20 00 to 21 00	18 00 to 19 00	12 00 to 15 00	12 00 to 13 00	12 00 to —	— to 12 00
10 00 to 12 00	....	9 00 to 10 50	9 00 to 10 50	12 50 to 13 50	11 00 to 12 00	9 50 to 10 50
12 50 to 14 00	14 00 to 15 00	11 25 to 12 50	11 25 to 12 50	14 00 to 15 00	12 00 to 13 50	11 00 to 12 50
17 60 to —	18 50 to —	22 50 to —	22 75 to 22 87½	22 65 to 22 75	19 80 to —	21 00 to —
14 75 to 15 00	16 25 to —	20 00 to —	22 00 to —	....	17 00 to 18 00	16 25 to 17 25
15 50 to 16 00	17 00 to —	19 50 to —	....	....	20 00 to 21 00	18 50 to 19 75
11¼ to 11¾	10⅝ to 12	13¼ to 13¾	14¼ to 15⅛	14 to —	14 to —	14½ to —
20 to 26	15 to 27	17 to 30	22 to 35	25 to 38	18 to 40	20 to 40
24 to 30	20 to 30	24 to 32	27 to 28	30 to 40	30 to 42	30 to 42
....	12½ to 14¼	10¼ to 13½	11¾ to 14	13 to 15	14 to 16½	14 to 16
....	11½ to 13	9 to 12	10 to 12½	11¾ to 14½	12¼ to 15¼	12 to 15⅛
15 to 16⅛	14½ to 16⅛	13¼ to 15⅛	13⅛ to 15⅜	13⅛ to 15¼	12¼ to 14	12¼ to 14½
17⅛ to 20	16½ to 19½	15⅝ to 18¼	15⅛ to 18½	15¼ to 17¼	14½ to 15½	14⅛ to 15½
7⅞ to 8⅛	....	7⅞ to 8½	8¼ to 9⅜	8⅛ to 8¾	8⅜ to 8¼	8¼ to 8⅜
8½ to —	8½ to 8¾	8½ to 8¾	8¼ to —	8¼ to —	8½ to —	8½ to —
4½ to 6½	5¾ to 7¼	6¼ to 9¾	6⅛ to 9½	10 to 12⅛	10½ to 13	8¼ to 12
6 to 8⅛	7½ to 10⅛	9 to 12½	9 to 11¼	12¼ to 15⅛	12½ to 17	12 to 16
53 to 68	53 to 68	55 to 60	53 to 65	58 to 68	58 to 68	53 to 65
47 to 57	47 to 55	47 to 56	47 to 55	47 to 57½	47 to 57½	47 to 56
50 to 65	50 to 65	51 to 65	51 to 65	55 to 62	55 to 62	51 to 65
33 to 52	46 to 52	33 to 53	33 to 53	38 to 50	33 to 50	33 to 45
23 to 37	20 to 37	23 to 35	23 to 37	25 to 36	25 to 36	25 to 36
20 to 27	17 to 28	17 to 25	17 to 27	26 to 28	25 to 28	18 to 28
....	....	....	....	....	18 to 37	18 to 36
4 75 to 5 25	4 70 to —	3 50 to 4 25	3 50 to 3 65	3 25 to 3 75	4 00 to 4 25	3 87½ to 4 00
6 00 to —	5 00 to 5 50	4 50 to 5 75	....	4 25 to —	5 50 to 5 75	4 37½ to 4 75
— to 8 75	6 50 to 7 50	6 00 to 7 75	6 00 to 6 25	5 75 to —	6 00 to —	5 37½ to 6 00
5 50 to 6 75	5 00 to 5 50	4 50 to 5 75	....	6 00 to 6 75	4 25 to 4 75	4 37½ to 4 75
6 25 to 9 75	6 50 to 7 75	6 00 to 9 25	5 75 to 7 25	7 00 to 8 50	5 00 to 7 75	5 25 to 6 25
1 45 to 1 55	1 30 to 1 40	1 28 to 1 32	1 18 to 1 23	1 18 to 1 25	1 10 to 1 20	1 18 to 1 22
1 60 to 1 68	1 52 to 1 58	1 34 to 1 38	1 27 to 1 29	1 23 to 1 28	1 20 to 1 25	1 25 to 1 28
1 65 to 1 69	....	1 33 to 1 50	1 35 to 1 38	1 25 to 1 45	....	1 30 to 1 35
1 45 to 1 49	....	1 20 to 1 23	1 13 to —	....	....	....
98 to —	98 to 1 00	91 to 93	88 to 92	1 00 to 1 05	1 07 to —	97 to 1 00
....	....	nominal.	1 05 to 1 25	1 30 to —	1 20 to 1 50	1 30 to 1 60
82 to 89	79 to 81	82 to 84	85 to 87	96 to 1 06	70 to 88	80 to 95
61 to 67½	61 to 67½	55 to 80	49 to 55	61 to 67	55 to 62	62 to 67
24 00 to 26 00	22 00 to 24 00	20 00 to 22 00	20 00 to 22 00	21 00 to 23 00	20 00 to 22 00	20 00 to 22 00
21 00 to 23 00	20 00 to 22 00	19 00 to 21 00	19 00 to 21 00	19 00 to 20 00	19 00 to 20 00	19 00 to 20 00
8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00	8 00 to 10 00
9 00 to 12 00	9 00 to 12 00	9 00 to 12 00	9 00 to 12 00	9 00 to 12 00	9 00 to 12 00	9 00 to 12 00
17 00 to —	17 00 to —	17 00 to —	17 00 to —	17 00 to —	17 00 to —	1 7 —
1[illegible] 00 to 18 25	18 25 to 18 50	23 75 to 24 00	24 00 to 24 50	24 25 to 24 50	20 50 to 21 00	21 00 to 22 00
16 00 to 16 50	16 50 to —	23 00 to —	23 00 to —	23 00 to —	19 00 to 19 50	20 00 to —
15 00 to —	16 00 to —	22 00 to —	22 00 to —	22 00 to —	19 00 to —	19 50 to —

MARKET-PRICES OF FARM-

The following quotations represent the state of the market,

Products.*	January.	February.	March.	April.	May.
PHILADELPHIA—Contin'd.					
Lard, ...lb.	$0 8¾ to $0 11½	$0 9¼ to $0 12½	$0 9½ to $0 12	$0 9¾ to $0 12½	$0 10¼ to $0 13
Butter, choice Middle State	30 to 42	40 to 45	42 to 48	40 to 44	33 to 40
choice western....	30 to 38	33 to 38	40 to 42	35 to 42	35 to 36
Cheese, N. Y. factory....	14 to 15	16 to 17	16 to 17	16¼ to 17½	16½ to 17½
Ohio factory.....	14 to 14½	13 to 16	14 to 16	15 to 16½	16 to 16½
Sugar, fair to good refining..............	7⅜ to 7⅝	7½ to 8	7¼ to 7¾	7⅜ to 7¾	7⅜ to 7¾
Cotton, ordinary to good ordinary.......	14 to 15½	13 to 14¾	12¾ to 14½	12½ to 15	13 to 15½
low middling to good middling..	15½ to 18½	15½ to 17½	15½ to 17½	16 to 17¾	16½ to 18¼
Wool, Ohio fleece, X and XX.............	55 to ——	52 to 56	51 to 56	55 to 57	56 to 58
Ohio combing.....	60 to 63	62½ to 65	60 to 62	—— to 65	60 to 63
pulled............	42½ to 50	46 to ——	40 to 51	46 to 50	47 to 49
unwashed, clothing and combing....	31 to 43	26 to 44	25½ to 42	37 to 45	21 to 37½
BALTIMORE.					
Flour, superfine .....bbl.	5 25 to 6 00	5 50 to 6 50	5 25 to 6 00	5 00 to 5 50	5 00 to 5 50
extra..............	6 75 to 8 50	6 50 to 8 00	6 00 to 6 75	6 50 to 8 00	5 75 to 7 50
family and fancy..	—— to 10 75	7 50 to 11 00	7 25 to 11 00	8 25 to 10 50	7 25 to 10 50
Wheat, white winter bush	1 70 to 1 90	1 70 to 1 90	1 70 to 1 85	1 60 to 1 85	1 60 to 1 85
amber winter	1 65 to 1 87	1 60 to 1 95	1 60 to 1 80	1 60 to 1 80	1 60 to 1 80
red winter	1 60 to 1 80	1 60 to 1 90	1 50 to 1 80	1 50 to 1 60	1 50 to 1 60
Rye......................	90 to 98	96 to 98	90 to 91	85 to 89	85 to 89
Corn, white southern.....	70 to 78	76 to 83	70 to 75	80 to 84	80 to 84
yellow southern....	74 to 80	73 to 78	70 to 74	80 to 83	80 to 83
Oats, southern	51 to 54	54 to 58	55 to 58	61 to 66	61 to 66
western	50 to 53	54 to 58	55 to 57	59 to 63	59 to 63
Hay, Pennsylvania ..ton.	20 00 to 24 00	20 00 to 24 00	18 00 to 22 00	17 00 to 20 00	17 00 to 20 00
Maryland...........	24 00 to 25 00	23 00 to 26 00	23 00 to 25 00	16 00 to 20 00	20 00 to 24 00
Pork, mess,..........bbl	15 50 to 16 25	16 50 to ——	16 00 to 16 25	16 50 to 16 75	16 50 to 16 75
Lard..................lb.	9 to 9½	9¾ to 10	8½ to 9	9¾ to 10½	9¾ to ——
Butter, western	24 to 35	30 to 40	30 to 38	28 to 38	28 to 32
eastern..........	24 to 35	35 to ——	34 to 35	35 to 42	—— to 42
Cheese, eastern	15¼ to 16	15¼ to 16	16¼ to 17	16¾ to 17	16¾ to 17
western..........	14½ to 15	14½ to 15	15½ to 16	16¼ to 17	16¼ to 17
Sugar, fair to good refining	7½ to 8	7¾ to 8	7½ to ——	7⅜ to 7¾	7⅜ to 7⅞
Tobacco, lugs	5 to 8	5 to 7	5 to 8	5 to 7	5 to 8
common to medium leaf.....	7 to 10	7 to 9	7 to 9	7 to 8	7 to 8½
Cotton, ordinary to good ordinary	14 to 14½	14 to ——	13 to 14½	13 to 14½	13 to 14½
low middling to middling.......	15¼ to 16½	15 to 16	14¾ to 16	15½ to 16½	15½ to 16½
CINCINNATI.					
Flour, superfine ....bbl.	5 00 to 5 50	5 25 to 5 75	5 00 to 5 50	5 00 to 5 50	5 00 to 5 50
extra..............	6 00 to 6 60	6 65 to 7 00	6 40 to 6 75	6 35 to 6 60	6 20 to 6 50
family	6 85 to 7 25	7 25 to 8 25	6 80 to 8 00	6 70 to 8 00	6 60 to 8 00
Wheat, red winter..bush.	1 30 to 1 52	1 48 to 1 50	1 35 to 1 43	1 37 to 1 40	1 43 to 1 48
hill or amber winter	1 55 to 1 60	1 55 to 1 63	1 45 to 1 50	1 43 to 1 47	1 45 to 1 48
white winter.....	1 60 to 1 65	1 65 to 1 70	1 48 to 1 55	1 45 to 1 50	1 50 to 1 60
Rye......................	93 to 95	94 to 96	1 01 to 1 02	1 03 to 1 05	1 08 to 1 10
Barley	1 20 to 1 60	1 60 to 1 85	1 70 to 1 85	1 45 to 1 70	1 40 to 1 50
Corn.....................	56 to 60	60 to 65	57 to 62	63 to 69	66 to ——
Oats	44 to 50	46 to 54	45 to 52	50 to 57	50 to 57
Hay, baled No. 1.....ton.	15 00 to 16 00	15 00 to 16 00	14 00 to 15 00	13 00 to 15 00	15 00 to 18 00
lower grades	10 00 to 14 00	10 00 to 14 00	9 00 to 14 00	9 00 to 12 00	9 00 to 12 00
Beef, plate...........bbl.	—— to ——	14 00 to ——	14 00 to ——	14 00 to ——	—— to ——
Pork, mess...............	15 25 to 15 50	15 50 to ——	14 25 to 14 50	16 00 to 16 25	16 70 to 17 00
Lard...................lb	8⅛ to 8½	9 to 10¼	8½ to 9	9½ to 9¾	10 to 10½
Butter, choice............	28 to 30	34 to 38	38 to 40	36 to 40	32 to 36
prime	25 to 27	31 to 33	35 to 36	34 to 36	27 to 30
Cheese, prime factory....	13½ to 14	16 to 17	16½ to 17	16¼ to 17	15 to 16
pine-apple	—— to ——	22 to 23	22 to 23	—— to ——	—— to ——
Sugar, New Orleans, fair to good	8½ to 9½	8½ to 9½	8¼ to 9½	8¼ to 9	8¼ to 9
prime to choice ...	9¾ to 10	9¼ to 10¾	9½ to 10	9¼ to 9¾	9½ to 9¾
Tobacco, lugs	9 to 12	6½ to 12	9 to 12	6 to 15	6 to 20
leaf	15 to 25	7 to 25	15 to 25	8 to 26½	6 to 29½

PRODUCTS FOR 1874.

as nearly as practicable, at the beginning of each month.

	June.	July.	August.	September.	October.	November.	December.
	$0 11½ to $0 15	$0 11 to $0 15	$0 13¾ to $0 16½	$0 14¼ to $0 15½	$0 14½ to $0 19	$0 13¾ to $0 14½	$0 14 to $0 18½
	28 to 33	25 to 30	30 to 33	33 to 34	35 to 40	38 to 40	30 to 45
	25 to 28	22 to 24	24 to 28	26 to 30	28 to 33	30 to 32	20 to 32
	15 to 17	14 to 15	12½ to 13½	13¼ to 14½	14 to 14½	16 to 16½	16 to 16½
	12 to 15½	12½ to 13	12 to 12½	12¼ to 13	13 to 14	15½ to 16	15½ to 16
	7⅛ to 7⅞	7⅞ to ——	7⅞ to 8⅛	7⅞ to 8¼	8½ to 8¾	8⅜ to 8⅝	8¼ to 8¾
	15 to 16¼	14 to 16	13¾ to 16	13½ to 16½	13 to 15⅝	12¾ to 14	12¾ to 14½
	18 to 20½	16¾ to 19½	16¼ to 18¾	16¾ to 18½	15¾ to 18½	14½ to 15½	14½ to 15¼
	53 to 58	53 to 56	53 to 57½	—— to 55	54 to 55	—— to ——	53½ to 55
	57½ to 65	62½ to ——	58 to 63	60 to 64	60 to 65	61 to 66	62 to ——
	46 to 55	42 to 48	45 to 52	—— to 49	42 to 47	32 to 46	31 to 46½
	22 to 45	36 to 43	23 to 42	33 to 45	41 to ——	25¼ to ——	27½ to 42¼
	4 50 to 5 25	4 00 to 4 75	4 25 to 4 75	4 25 to 5 00	4 00 to 4 50	4 12½ to 4 37½	4 00 to 4 50
	5 50 to 6 50	5 00 to 7 50	5 00 to 6 00	4 75 to 6 25	4 75 to 7 00	4 75 to 5 50	4 75 to 5 50
	6 75 to 10 00	8 00 to 9 50	6 00 to 8 00	6 00 to 8 00	7 25 to 8 75	5 45 to 7 00	5 50 to 8 50
	1 50 to 1 65	1 50 to 1 65	1 25 to 1 45	1 10 to 1 25	1 18 to 1 28	1 15 to 1 30	1 20 to 1 40
	1 62 to 1 65	—— to 1 62	1 42 to 1 45	1 30 to 1 35	1 30 to 1 38	1 20 to 1 30	1 25 to 1 38
	1 30 to 1 45	1 30 to 1 65	1 20 to 1 30	1 10 to 1 28	1 06 to 1 30	1 15 to 1 23	1 22 to 1 33
	1 05 to 1 10	90 to 95	80 to 85	85 to 90	98 to 1 03	1 00 to 1 05	1 00 to 1 05
	90 to 92	90 to 91	90 to 92	93 to 94	1 00 to 1 03	80 to 95	75 to 82
	78 to 79	83 to ——	83 to 84	81 to 82	1 00 to 1 03	80 to 83	75 to 82
	70 to 74	65 to 72	60 to 65	52 to 55	62 to 65	58 to 60	62 to 65
	62 to 65	65 to 68	60 to 63	51 to 55	63 to 64	55 to 60	62 to 64
	19 00 to 22 00	16 00 to 20 00	20 00 to 21 00	18 00 to 19 00	18 00 to 20 00	17 00 to 20 00	17 00 to 19 00
	18 00 to 25 00	16 00 to 23 00	22 00 to 23 00	20 00 to 22 00	18 00 to 21 00	17 00 to 21 00	17 00 to 21 00
	18 25 to 18 50	18 00 to ——	24 00 to 25 00	24 00 to ——	24 00 to ——	21 50 to ——	21 00 to ——
	11½ to 12	12 to 12½	14 to ——	15 to ——	15½ to 16	15 to 15½	15½ to 17
	18 to 25	23 to 25	24 to 25	23 to 28	24 to 35	22 to 36	18 to 36
	—— to ——	—— to ——	—— to ——	—— to ——	36 to 45	33 to 40	26 to 40
	16 to 16½	15 to ——	14 to ——	14½ to 15	15½ to 16½	16 to 16½	15½ to 16½
	15½ to 16½	12½ to 13¼	12½ to 13	13 to 13½	14 to 15½	14½ to 15¾	15 to 16
	7¾ to 8	7¾ to 8	7¾ to 8	7⅞ to 8¼	8½ to 8¾	8½ to 8¾	8⅛ to 8⅜
	5 to 8	4½ to 6	—— to ——	—— to ——	6 to 9½	6 to 11½	6 to 11½
	7 to 8½	6 to 8½	—— to ——	—— to ——	8½ to 11	8½ to 14½	8½ to 13
	—— to 16	—— to 15½	14¼ to 15½	14¾ to 15½	—— to 14	—— to 13¾	—— to 14
	17½ to ——	16½ to 17⅜	15½ to 16¾	15⅜ to 16¾	14½ to 15	13⅛ to 14	14⅛ to 14½
	4 85 to 5 25	4 75 to 5 00	4 20 to 4 50	3 75 to 4 25	4 00 to 4 35	3 75 to 4 00	3 75 to 4 00
	5 75 to 6 00	5 50 to 5 75	—— to ——	—— to ——	5 to to 5 15	4 65 to 4 85	4 75 to 4 90
	6 00 to 7 50	5 60 to 6 00	5 25 to 6 75	5 15 to 6 50	5 15 to 6 25	4 85 to 6 00	5 00 to 6 00
	1 23 to 1 30	1 18 to 1 20	1 04 to 1 07	1 03 to ——	1 00 to 1 06	1 00 to 1 06	1 03 to 1 10
	1 32 to ——	—— to ——	1 08 to 1 12	1 05 to 1 10	1 08 to 1 12	1 08 to 1 12	1 07 to 1 12
	1 25 to 1 30	1 20 to 1 23	1 18 to 1 23	1 10 to 1 12	1 08 to 1 15	1 05 to 1 16	1 05 to 1 20
	1 05 to 1 06	90 to ——	90 to 92	82 to 83	98 to 1 00	92 to 95	1 05 to 1 07
	1 20 to 1 25	—— to ——	—— to ——	1 00 to 1 05	1 30 to 1 45	1 05 to 1 40	1 20 to 1 55
	65 to 67	55 to 71	66 to 71	70 to 75	84 to 85	60 to 80	70 to 73
	50 to 68	48 to 56	48 to 50	46 to 48	56 to 58	52 to 55	56 to 60
	16 00 to 19 00	17 00 to 20 00	20 00 to 25 00	20 00 to 22 00	20 00 to 23 00	21 00 to 23 00	20 00 to 23 00
	10 00 to 14 00	10 00 to 14 00	15 00 to 17 00	16 00 to 19 00	15 00 to 19 00	15 00 to 19 00	15 00 to 19 00
	15 00 to ——	13 00 to 14 50	14 00 to 15 00	13 50 to 15 00	14 50 to 15 00	—— to ——	—— to ——
	17 75 to 18 00	18 00 to 18 25	23 75 to 24 00	23 00 to ——	26 00 to 26 50	—— to ——	20 75 to 21 00
	10¾ to 11½	11¾ to 12	14 to 14½	16½ to ——	—— to ——	11 to 11½	13 to 14½
	20 to 22	18 to 20	23 to 25	25 to 28	33 to 35	—— to 30	27 to 33
	18 to ——	22 to 23	19 to 20	23 to 25	28 to 32	25 to 28	24 to 26
	13½ to 14	12 to 12½	12 to 12½	12½ to 13	14½ to 15½	15¼ to 16	15 to 15¼
	—— to ——	—— to ——	—— to ——	—— to ——	—— to ——	—— to ——	—— to ——
	8½ to 9½	8½ to 9½	—— to ——	—— to ——	—— to ——	—— to ——	8¼ to 8¾
	9½ to 9¾	9¼ to 9¾	9¾ to 10	9¼ to 10	—— to ——	—— to ——	9 to 9¼
	6 to 20	9 to 20	15 to 22½	15 to 22½	12 to 25	12 to 25	12 to 25
	8 to 29½	12 to 34½	22½ to 37½	22½ to 37½	15 to 37½	15 to 37½	15 to 37½

MARKET-PRICES OF FARM-

The following quotations represent the state of the market,

Products.	January.	February.	March.	April.	May.
CINCINNATI—Continued.					
Cotton, ordinary to good ordinary	$0 12¼ to $0 13¾	$0 11½ to $4 13⅜	$0 11½ to $0 13½	$0 12 to $0 14	$0 13½ to $0 15¼
low middling to good middling	14⅜ to 16¼	14¼ to 15¾	14½ to 16¾	15 to 17	16¼ to 17¾
Wool, fleece, common to fine	45 to 46	45 to 47	45 to 47	45 to 47	45 to 47
tub-washed	48 to 49	48 to 49	48 to 49	48 to 50	48 to 50
unwashed clothing	30 to 32	30 to 32	30 to 32	30 to 32	30 to 32
unwashed combing	33 to 35	33 to 35	33 to 35	33 to 35	33 to 35
pulled	35 to 37	35 to 38	35 to 38	35 to 38	38 to 40
CHICAGO.					
Flour, white winter extras ...bbl.	6 75 to 9 25	6 50 to 9 25	6 50 to 9 25	7 00 to 9 25	7 00 to 9 00
red winter extras	5 75 to 7 00	6 00 to 7 75	5 75 to 7 50	5 50 to 7 00	5 50 to 7 00
spring extras	4 75 to 6 25	6 00 to 6 75	5 00 to 6 75	5 75 to 6 75	5 37½ to 10 00
spring superfines	2 50 to 4 25	3 00 to 5 00	3 00 to 4 50	3 00 to 4 75	3 50 to 4 87½
Wheat, No. 1 spring...bush	1 20 to —	1 23¾ to 1 24	1 19 to 1 20	1 25 to —	1 29 to 1 33
No. 2 spring	1 17¼ to 1 18	1 22¼ to 1 23½	1 16¾ to 1 17½	1 19 to 1 22½	1 28¾ to —
No. 2 spring	1 14 to 1 14⅜	1 15 to 1 16	1 12⅝ to —	1 17 to —	1 19¾ to —
Corn, No. 2	49 to 53⅛	51¼ to 58½	53½ to 57¼	58½ to 63½	63½ to 66½
Oats, No. 2	38⅜ to —	42 to 42½	42⅛ to 42⅝	42⅜ to 48	46¾ to 47
Rye, No. 2	73 to 80	81 to 82	84⅜ to 85⅛	90 to 93	91 to 92
Barley, No. 2	1 43 to 1 45	1 95 to 2 05	1 59 to —	1 52 to —	1 60 to 1 65
Hay, timothy ...ton	11 00 to 11 50	10 00 to 14 00	10 00 to 14 50	10 50 to 14 00	16 00 to 18 50
prairie	7 00 to 10 50	6 00 to 9 00	6 00 to 9 50	8 00 to 10 00	14 00 to 15 00
Beef, mess ...bbl.	8 25 to 8 50	8 25 to 8 50	8 75 to 9 00	8 75 to 9 00	9 75 to 10 00
extra mess	9 75 to 10 00	9 75 to 10 00	9 75 to 10 00	9 75 to 10 00	10 75 to 11 00
Pork, mess	14 35 to 14 40	14 40 to 14 42½	13 85 to 14 00	15 00 to 15 50	16 45 to —
prime mess	13 00 to 13 25	12 75 to 13 00	12 25 to 12 50	12 00 to 13 25	— to —
extra prime	11 00 to 11 25	12 00 to 12 25	11 00 to 11 25	11 75 to 12 00	— to —
Lard ...lb.	— to 8⅝	9¼ to 9¾	8⅜ to 8⅞	— to 9½	10 to 10¼
Butter, choice to fancy	30 to 34	33 to 37	38 to 43	36 to 40	33 to 36
medium to good	22 to 27	25 to 31	30 to 35	32 to 34	27 to 30
Cheese, New York factory	15 to 16	16 to 17¼	17 to 18	17 to 18	15 to 15½
Ohio and western factory	14 to 15	15½ to 16¼	16 to 17	16 to 17	15 to 15¼
Sugar, New Orleans prime to choice	8¾ to 9⅜	9 to 9¾	9 to 9⅞	9 to 9¾	8¾ to 9¾
New Orleans common to fair	7⅜ to 8½	7¾ to 8⅞	7¼ to 8¾	7¼ to 8⅜	7¼ to 8½
Wool, tub-washed	40 to 50	48 to 55	48 to 55	48 to 55	48 to 55
fleece-washed	36 to 45	36 to 48	37 to 48	36 to 48	35 to 47
unwashed	25 to 32	25 to 34	25 to 32	25 to 32	25 to 33
pulled	30 to 35	35 to 40	35 to 40	35 to 40	35 to 40
SAINT LOUIS.					
Flour, spring ...bbl.	5 00 to 5 50	6 00 to 6 40	4 50 to 6 25	4 25 to 6 00	4 25 to 6 00
winter	4 85 to 9 50	5 00 to 9 50	5 00 to 9 25	4 25 to 9 00	4 25 to 9 00
Wheat, red winter ...bush.	1 24 to 1 70	1 25 to 1 70	1 40 to 1 60	1 32 to 1 60	1 15 to 1 42
white winter	1 40 to 1 68	1 40 to 1 70	1 36 to 1 60	1 55 to 1 60	1 40 to 1 50
spring	1 18 to 1 28	1 25 to 1 30	1 19 to 1 21	1 23¼ to 1 25	1 10 to 1 20
Corn	53 to 63	61 to 70	59 to 68	66 to 70	54 to 70
Rye	80 to 83	83 to 86	87 to 95	1 00 to 1 05	93 to 95
Barley	1 05 to 1 60	1 40 to 2 00	1 40 to 1 90	1 25 to 1 65	1 00 to 1 30
Oats	37¼ to 48	45 to 52	46 to 51	48 to 58½	47 to 52
Hay, timothy ...ton.	16 00 to 17 00	15 00 to 18 00	16 00 to 19 00	24 00 to 27 00	20 00 to 24 00
prairie	12 00 to —	9 00 to 11 00	9 00 to 11 00	12 00 to 15 00	16 00 to 20 00
Beef, mess ...bbl.	13 00 to —	11 00 to 13 00	11 00 to 13 00	11 00 to 13 00	12 50 to 13 50
Pork, mess	14 50 to 15 00	15 25 to 15 50	15 25 to 15 50	16 75 to 17 00	17 50 to 18 00
Lard ...lb.	7½ to 9¼	7½ to 9½	8 to 9¾	9¼ to 10¾	10 to 12
Butter, prime to choice	28 to 32	28 to 37	28 to 37	28 to 34	20 to 30
medium to good	20 to 25	22 to 27	24 to 27	22 to 27	15 to 20
Cheese, N. Y. factory	13¾ to 14	15½ to 16½	15¼ to 16½	16 to 17	16 to 17
Ohio factory	13½ to 14	15 to 16	15 to 16	17 to 18½	17 to 18¼
Cotton, low middling to middling	14 to 15½	14½ to 15½	14⅜ to 15¼	15¾ to 17½	— to 17¾
ordinary to good ordinary	— to —	10 to 12¾	11 to 13½	12½ to 14½	14 to 15¼
Wool, tub-washed	50 to 52	48 to 51	49 to 52	52 to 53	44 to 50
fleece-washed	35 to 42	28 to 32	40 to 45	40 to 45	35 to 45
unwashed	29 to 31	30 to 34	32 to 35	33 to 35	28 to 36

PRODUCTS FOR 1874.

as nearly as practicable, at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$0 14 to $0 16	$0 13½ to $0 15	$0 13 to $0 14⅝	$0 12¾ to $0 14⅜	$0 12½ to $0 13¾	$0 11½ to $0 13	$0 12 to $0 13⅜
17 to 18¼	16 to 18¼	15⅛ to 17⅛	15½ to 17⅜	14⅛ to 16	13⅜ to 14¼	13⅞ to 14⅜
40 to 42	40 to 43	42 to 45	42 to 45	43 to 47	43 to 47	43 to 47
42 to 45	44 to 46	45 to 48	45 to 50	50 to 52	50 to 52	48 to 50
28 to 30	30 to 31	30 to 31	30 to 31	32 to 34	32 to 34	32 to 33
35 to 37	35 to 38	35 to 38	35 to 38	35 to 39	35 to 39	35 to 38
35 to 36	32 to 33	32 to 35	32 to 35	35 to 38	37 to 38	35 to 38
6 75 to 9 00	6 00 to 8 00	5 75 to 7 75	5 50 to 7 50	6 00 to 7 25	5 25 to 6 25	— to —
5 50 to 7 00	5 50 to 6 50	5 50 to 6 50	4 75 to 6 50	5 50 to 6 00	— to —	— to —
5 25 to 10 00	5 00 to 6 50	5 00 to 5 75	5 12½ to 5 50	4 62½ to 5 50	4 25 to $5 00	4 40 to 4 75
3 50 to 4 87½	3 50 to 4 73	3 50 to 4 75	3 50 to 4 50	3 50 to 4 25	3 00 to 4 00	3 12½ to 3 65
1 20½ to 1 21	1 19 to 1 19½	1 08 to —	97 to —	98 to 99	88 to —	94 to —
1 16 to 1 16½	1 16 to 1 16¾	— to —	93⅛ to 93¼	98 to 99	83 to 83⅜	92⅛ to —
1 13 to —	1 09½ to 1 10	— to 97	90 to —	85 to 90	79 to —	85 to —
56¼ to 56⅝	58⅜ to 59	63 to 90	66⅛ to 67⅛	81 to 83	70 to 71⅝	74 to 77
43¼ to 45	42 to 43¼	43 to 71	40 to 41⅛	49 to 53	40⅛ to 47¾	53⅛ to 54
90 to 92	83 to 86	73 to 76	75 to 75½	89 to 90	82 to 83	94 to —
1 40 to 1 45	1 10 to 1 20	1 03 to 1 05	93 to —	1 00 to 1 15	1 24 to 1 32	1 21 to 1 25
15 00 to 19 00	11 50 to 14 00	17 50 to 18 00	11 50 to 15 50	14 50 to 16 50	13 00 to 16 50	13 00 to 18 00
8 00 to 12 00	7 50 to 9 00	5 00 to 10 00	8 00 to 10 00	11 00 to 12 50	8 50 to 13 00	9 00 to 13 50
10 75 to 11 00	11 00 to 11 25	11 25 to 11 50	11 25 to 11 50	9 50 to —	8 50 to —	8 25 to —
11 75 to 12 00	12 00 to 12 25	12 25 to 12 50	12 25 to 12 50	10 50 to —	9 50 to —	9 25 to —
17 30 to —	17 70 to 17 75	23 25 to 23 30	23 00 to —	21 75 to 22 00	18 00 to 19 50	20 25 to 20 30
— to —	— to —	— to —	— to —	— to —	— to —	17 75 to 18 00
— to —	— to —	— to —	— to —	— to —	— to —	15 00 to 15 50
10½ to —	11 to 11½	12⅛ to 12¼	15 to 12⅛	14⅛ to 14⅜	12⅞ to 12⅛	— to 13½
23 to 25	21 to 24	25 to 28	28 to 33	30 to 35	30 to 38	33 to 38
18 to 22	16 to 18	20 to 23	22 to 25	23 to 27	24 to 28	25 to 28
14 to 15	11 to 12	11 to 12	12½ to 13	13½ to 14½	15 to 16	15 to 15½
13 to 14⅛	10½ to 11	10 to 11	11½ to 12½	12⅛ to 13⅛	14 to 15	14 to 14½
9¼ to 9¾	— to —	— to —	— to —	— to —	9⅛ to 9⅞	— to 9¼
7¼ to 8½	— to —	— to —	— to —	— to —	8⅛ to 9¼	8¼ to —
49 to 52	45 to 50	46 to 53	45 to 55	45 to 57	45 to 57	45 to 57
35 to 42	38 to 44	38 to 44	40 to 47	40 to 50	40 to 50	40 to 47
25 to 32	27 to 33	27 to 33	27 to 34	27 to 35	27 to 35	27 to 34
— to —	— to —	— to —	— to —	— to —	— to —	— to —
4 25 to 6 00	4 25 to 6 00	4 25 to 6 00	3 00 to 4 50	3 00 to 4 50	3 00 to 4 50	3 00 to 4 50
4 25 to 9 00	4 25 to 9 00	4 25 to 9 00	3 00 to 8 00	3 00 to 8 00	3 00 to 8 00	3 00 to 7 00
1 15 to 1 42	95 to 1 35	1 20 to 1 25	1 00 to 1 18	93 to 1 17	90 to 1 12	95 to 1 12
1 40 to 1 50	1 30 to 1 35	95 to 1 20	1 18 to 1 22	1 00 to 1 20	1 00 to 1 10	95 to 1 08
1 10 to 1 20	90 to 1 00	96 to 1 00	80 to 85	80 to 90	80 to 85	88 to 92
54 to 70	59 to 70	62 to 76	67 to 74	79 to 90	70 to 75	67 to 82
93 to 95	65 to 80	60 to 1 05	75 to 80	90 to 95	83 to 86	90 to 97
1 00 to 1 30	— to —	1 00 to 1 15	95 to 1 20	95 to 1 20	95 to 1 20	1 10 to 1 42
47 to 52	45 to 52	40 to 48	43 to 45	50 to 54	49 to 51	52 to 56
20 00 to 24 00	24 00 to 28 00	18 00 to 21 00	17 00 to 20 00	17 00 to 20 00	19 00 to 24 00	19 00 to 22 00
16 00 to 20 00	10 00 to 13 00	10 00 to 13 00	11 00 to 14 00	11 00 to 14 00	12 00 to 15 00	12 00 to 16 00
12 50 to 13 50	12 50 to 13 50	12 50 to 13 50	14 00 to 15 00	14 00 to 15 00	14 00 to 15 00	14 00 to 15 00
17 50 to 18 00	18 50 to 18 75	22 00 to 24 00	24 00 to 25 00	23 50 to 23 75	21 50 to 22 00	19 70 to 20 50
19 to 12	10 to 12	10 to 12	11 to 14	12 to 15	12 to 15	12 to 14
20 to 30	18 to 28	18 to 28	20 to 28	25 to 35	28 to 36	32 to 36
15 to 20	14 to 18	14 to 18	16 to 20	20 to 25	22 to 26	28 to 33
16 to 17	16 to 17	16 to 17	16 to 17	13 to 13½	13 to 13½	13 to 13½
17 to 18½	17 to 18¼	17 to 18½	17½ to 18	13⅛ to 14	13 to 13⅛	13 to 13½
... to 17½	— to 17⅛	— to 17⅛	15½ to 16⅛	14⅛ to 15½	14 to 15	13⅞ to
14 to 15⅛	14 to 15⅛	14 to 15⅛	12 to 14½	12½ to 13¾	11⅛ to 13½	12 to
44 to 50	49 to 31	49 to 51	49 to 52	50 to 53	50 to 53	50 to 54
35 to 45	32 to 40	32 to 40	32 to 40	32 to 45	32 to 45	32 to 52
28 to 36	27 to 33	27 to 33	27 to 33	27 to 33	27 to 33	28 to 36

MARKET-PRICES OF FARM-

The following quotations represent the state of the market,

Products.	January.	February.	March.	April.	May.
NEW ORLEANS.					
Flour, superfine .....bbl.	$5 25 to $5 50	$5 50 to $5 75	$5 25 to —	$4 75 to —	$4 80 to $5 00
extras............	6 00 to 7 00	5 90 to 7 25	5 62½ to $7 50	5 25 to $6 75	5 25 to 6 75
choice to fancy....	8 00 to 9 75	7 50 to 9 75	7 75 to 9 75	7 25 to 9 50	7 00 to 9 50
Corn, white ....bush.	71 to 72	72 to 75	75 to 77	75 to 76	88 to 90
yellow	70 to 74	— to 75	— to 82	— to 80	88 to —
Oats	57 to 58	57 to 58	63 to —	62 to 65	60 to 62
Hay, choice..........ton.	25 00 to —	23 00 to 24 00	— to —	21 00 to 22 00	23 00 to —
prime	21 00 to —	22 00 to —	21 00 to —	17 00 to 19 00	20 00 to —
Beef, Texas..........bbl.	11 00 to 12 00	12 00 to —	12 00 to —	12 00 to —	12 00 to 12 25
Fulton Market ½bbl	11 00 to 12 00	12 00 to —	12 00 to —	12 00 to —	12 50 to —
western.... ...bbl.	18 00 to 19 00	18 00 to 18 50	— to —	18 00 to 18 50	18 00 to 18 50
Pork, mess............	15 25 to —	15 62½ to 15 75	16 00 to —	16 87½ to 17 00	17 75 to 18 00
Lard...... ....lb.	8½ to 9½	9 to 9½	9 to 10	9 to 10½	10 to 11
Butter, choice northern ..	42 to —	40 to 42	38 to 48	45 to 46	38 to 40
western ...	30 to 33	27 to 35	28 to 38	33 to 38	33 to 40
Cheese, western factory..	14½ to 15	14½ to —	17 to —	17 to —	17 to —
N. Y. cream......	17 to —	17½ to —	19 to —	19 to 20	19 to 20
Sugar, fair to full fair....	6½ to 7	6½ to 8	7 to 7½	7 to 7½	7¼ to 8¼
prime to strictly prime..........	8 to 8¼	8⅛ to 8½	8¼ to —	7½ to 7¾	8¼ to —
clarified, white and yellow	8½ to 10	9¼ to 10½	8 to 9¼	9 to 9½	9¼ to 10½
Cotton, ordinary to good ordinary........	11½ to 13¼	11½ to 14⅛	11½ to 13½	12½ to 14⅛	13⅛ to 15¼
low middling to good middling ..	14⅝ to 17½	15¼ to 17¾	14⅞ to 17½	15⅝ to 17½	16⅜ to 17¼
Tobacco, lugs	5⅛ to 7½	5½ to 7½	5 to 6½	4½ to 5½	4 to 4½
low leaf to medium leaf	7¾ to 9½	7¾ to 9¾	6½ to 8	5½ to 8	6½ to 8
Wool, lake	25 to —	25 to —	— to —	nominal.	— to —
SAN FRANCISCO.					
Flour, superfine .....bbl.	5 50 to 5 75	5 50 to 5 75	5 25 to 5 50	4 50 to 5 00	4 50 to 4 75
extra...............	6 00 to —	6 00 to —	5 75 to 6 00	5 25 to 5 50	5 00 to 5 25
family and fancy ..	6 25 to 7 00	6 50 to 7 00	6 25 to 6 50	5 75 to 6 00	5 50 to 5 75
Wheat, California.cental.	2 25 to 2 30	2 15 to 2 25	1 85 to 1 95	1 90 to 2 00	1 75 to 1 95
Oregon...........	2 25 to 2 30	2 15 to 2 25	1 85 to 1 95	1 90 to 2 00	1 75 to 1 95
Barley....................	1 35 to 1 65	1 40 to 1 65	1 45 to 1 75	1 55 to 1 75	1 60 to 1 90
Oats	1 60 to 1 85	1 50 to 1 80	1 45 to 1 75	1 60 to 1 80	1 55 to 1 65
Corn.....................	1 40 to 1 45	1 60 to 1 65	1 65 to 1 70	1 65 to 1 70	1 65 to 1 75
Hay, State........ ...ton.	13 00 to 18 00	14 00 to 17 00	12 50 to 16 50	16 00 to 18 50	14 50 to 19 00
Beef, mess ....bbl.	9 50 to 10 00	9 50 to 10 00	9 00 to 9 50	8 50 to 9 00	8 50 to 9 00
family mess...½ bbl.	9 00 to 10 00	9 00 to 10 00	9 00 to 10 00	9 00 to 10 00	9 00 to 10 00
Pork, mess........ ...bbl.	18 00 to 18 50	18 00 to 18 50	17 00 to 17 50	17 00 to 17 50	18 50 to 19 00
prime mess.........	16 00 to 16 50	17 50 to 18 00	17 50 to 18 00	16 50 to 17 50	17 00 to 17 50
Lard............... ...lb.	10 to 11	10 to 11	10 to 11	10 to 13	11 to 13
Butter, overland	15 to 25	15 to 25	15 to 25	15 to 25	15 to 20
California	30 to 45	30 to 38	30 to 38	30 to 35	25 to 28
Oregon	15 to 20	15 to 20	15 to 20	15 to 20	15 to 20
Cheese....................	12 to 18	12 to 18	12 to 18	15 to 18	12½ to 16
Wool, native..............	13 to 16	14 to 16	14 to —	14 to 16	14 to 16
California	18 to 22	18 to 22	18 to —	16 to 22	20 to 25
Oregon.............	18 to 22	18 to 22	18 to —	16 to 22	20 to 25

PRODUCTS FOR 1874.

as nearly as practicable, at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
— to —	$5 00 to —	— to $4 50	— to $4 00	$4 00 to —	$4 25 to —	$4 25 to $4 37½
$6 00 to $6 50	5 50 to $6 50	— to 4 75	$4 25 to 5 25	4 25 to $6 50	4 50 to $5 75	4 50 to 5 25
6 75 to 9 50	7 00 to 8 75	$7 75 to 8 50	6 25 to 7 00	6 62½ to 7 00	5 85 to 7 00	5 37½ to 6 50
70 to —	81 to —	90 to 92½	30 to 92	98 to 1 00	1 05 to —	1 07½ to 1 08
70 to —	82 to 85	77 to 78	— to 80	97 to 98	1 00 to 1 02½	1 05 to —
58 to 60	62 to 64	75 to 80	56 to 60	64 to 65	62 to 63	70 to 72
— to —	— to —	26 50 to 27 00	— to 26 00	25 00 to 26 50	27 00 to 28 00	27 00 to 29 00
23 00 to 25 00	24 00 to 25 00	25 00 to 25 50	23 00 to 24 00	24 00 to 25 00	25 00 to 26 50	26 50 to —
12 00 to 12 25	12 00 to 12 25	12 00 to 12 25	12 00 to 12 25	— to —	— to —	— to —
12 00 to —	11 25 to 11 50	11 25 to 11 50	11 25 to 11 50	11 00 to 11 50	11 00 to 11 50	11 25 to 11 50
18 00 to 18 50	15 50 to 16 00	15 00 to 16 00	15 00 to 16 00	— to —	— to —	18 00 to —
18 75 to —	20 00 to 21 00	25 50 to —	— to 24 50	24 00 to 24 50	22 00 to 22 50	21 00 to 23 00
12½ to 12¾	12 to 12½	— to 15	— to 15½	16 to 17½	14½ to 15½	15¾ to 16
36 to 38	32 to 34	— to —	28 to 30	— to 42	40 to —	42 to 43
28 to 30	17 to 22	20 to 25	20 to 22	25 to 35	30 to 32	28 to 30
15 to 15½	16 to —	— to 14	— to 13	15½ to 16	15 to 15½	15 to 15½
18 to —	— to —	— to 19	— to 19	18 to —	17½ to 18	16 to 18
8⅛ to 8¾	8 to 8½	9⅛ to 9½	9¼ to 9½	— to —	8⅞ to 9¼	6¼ to 7½
9 to —	9 to 9½	— to —	9¾ to 9⅞	10¼ to 10¾	8¾ to 9½	7½ to 8¼
10 to —	10½ to —	— to —	10⅜ to 11¼	10⅜ to 10⅝	10 to 10½	8⅝ to 10¼
13¼ to 15½	12⅜ to 14¼	11¼ to 14¼	11¼ to 14¼	11⅜ to 13¼	13 to 13¼	— to 13¼
16¾ to 18⅜	15¼ to 18¼	15⅜ to 16¾	16 to 17	14¼ to 15½	13⅜ to 14½	14¼ to 15
4 to 6	5¾ to 7¾	7½ to 9	7½ to 9	8½ to 10¼	9 to 11½	9 to 11½
6½ to 8	8 to 9¾	9½ to 11½	9½ to 12	10¾ to 13	12 to 14	12 to 14
32½ to 34	34 to —	— to 34	— to 34	34½ to —	— to —	25 to —
4 50 to 4 75	4 50 to 4 75	4 00 to 4 50	4 25 to 4 50	4 00 to 4 35	3 90 to 4 25	4 00 to 4 25
5 00 to 5 25	5 00 to 5 50	— to 4 75	— to 4 75	4 50 to 4 62½	4 62½ to 4 87½	4 50 to 4 75
5 50 to 5 75	5 50 to 6 00	5 00 to 6 00	5 00 to 5 25	4 75 to —	5 00 to 5 12½	5 00 to 5 12½
1 65 to 1 85	1 65 to 1 85	1 50 to 1 65	1 45 to 1 60	1 40 to 1 50	1 35 to 1 55	1 35 to 1 55
1 65 to 1 85	1 65 to 1 85	1 50 to 1 60	1 50 to 1 60	1 40 to 1 50	1 40 to 1 50	1 40 to 1 55
1 50 to 1 85	1 00 to 1 75	1 12½ to 1 40	1 05 to 1 75	1 05 to 1 25	1 05 to 1 35	1 15 to 1 45
1 50 to 1 75	1 50 to 1 75	1 40 to 1 75	1 45 to 1 65	1 45 to 1 65	1 25 to 1 65	1 25 to 1 65
1 90 to 2 00	1 90 to 2 00	— to —	1 80 to 1 85	1 55 to 1 60	1 25 to 1 30	1 35 to 1 42½
10 00 to 17 00	10 00 to 14 00	11 00 to 14 50	8 00 to 13 50	8 00 to 14 00	9 00 to 15 00	17 00 to —
8 50 to 9 50	8 50 to 9 00	8 50 to 10 00	8 50 to 10 00	8 50 to 10 00	9 00 to —	9 00 to 10 00
9 00 to 10 00	10 00 to 12 00	6 50 to 8 00	6 50 to 8 00	6 50 to 8 00	— to —	6 50 to 8 00
18 00 to 19 00	19 00 to 20 00	19 00 to 20 00	22 00 to 24 00	22 00 to 24 00	22 00 to 24 00	23 00 to 24 00
18 00 to 18 50	16 50 to —	17 50 to 18 00	17 50 to 18 50	17 50 to 18 50	17 50 to 18 50	18 00 to 21 00
11¾ to 12½	12 to 13½	13 to 14	15 to 16	15 to 16	15 to 16	14½ to 16
15 to 20	20 to 22	20 to 22	20 to 25	20 to 25	20 to 25	25 to 40
25 to 30	25 to 30	25 to 35	25 to 40	25 to 50	25 to 50	25 to 60
15 to 20	18 to 20	18 to 20	18 to 20	18 to 25	20 to 30	20 to 35
12½ to 16	12½ to 16	12½ to 16	12½ to 16	12½ to 16	12½ to 16	12½ to 16
15 to 17	17 to 19	17 to 19	17 to 19	17 to 22	14 to 22	12 to 20
20 to 28	25 to 32	25 to 32	25 to 32	25 to 30	18 to 22	15 to 20
20 to 28	25 to 32	25 to 33	25 to 32	25 to 30	20 to 22	18 to 20

MARKET-PRICES

The following quotations represent the state of the markets,

Kind of stock.	January. From—	January. To—	February. From—	February. To—	March. From—	March. To—	April. From—	April. To—	May. From—	May. To—
NEW YORK.										
Cattle, extra beeves . cental.	$12 50	$13 00	$12 50	$12 75	$12 00	$13 00	$12 75	$13 00	....	$12 75
good to prime	11 75	12 25	11 75	12 25	11 50	12 25	11 50	12 50	$11 50	....
common to fair	10 25	11 50	10 00	11 50	9 75	11 25	10 00	....	10 00	....
milch cows.....head.	40 00	80 00	40 00	80 00	40 00	80 00	35 00	80 00	....	....
calves	6 00	12 00	8 00	13 00	8 00	15 00	6 50	10 50	8 00	....
Sheep ....cental.	3 50	7 37½	6 50	8 12½	6 00	8 00	....	9 25	5 00	8 50
Swine	5 37½	5 87½	6 25	6 75	6 62	7 25	5 50	8 50	5 50	7 50
PHILADELPHIA.										
Cattle, common to choice beeves ....cental.	3 50	8 00	4 00	7 75	4 00	8 00	4 50	7 75	4 50	7 50
Sheep	4 50	6 25	5 00	7 25	5 50	7 50	6 00	8 62½	6 00	9 00
Swine, corn-fed	7 50	7 75	9 25	9 50	8 50	9 00	8 59	9 00	8 75	9 00
BALTIMORE.										
Cattle, best beeves...cental.	5 75	7 00	5 75	6 87	5 75	7 00	6 25	7 12	6 50	7 25
first quality	4 75	5 75	4 50	5 75	4 62	5 75	5 25	6 25	5 62	6 50
medium	4 00	4 75	4 00	4 50	4 00	4 62	4 75	5 25	5 25	5 62
gen'l av'ge of market.	5 12	....	4 75	....	4 75	....	5 87	....	6 00	....
Sheep	4 00	6 50	4 00	7 00	2 50	7 75	4 50	8 50	6 00	8 00
Swine, corn-fed	7 00	8 25	7 25	8 25	7 25	8 25	7 50	8 37½	7 50	8 25
CINCINNATI.										
Cattle, butchers' steers, cent'l	2 75	5 25	4 75	5 50	5 25	5 50	5 25	5 75	5 00	5 75
shipping grades	4 50	5 25	4 00	4 50	3 25	5 00	3 50	5 00	4 00	4 75
milch cows.....head.	35 00	60 00	30 00	50 00	25 00	65 00	30 00	60 00	30 00	65 00
calves ....cental.	6 00	7 00	2 25	4 25	4 50	....	6 00	7 50	5 00	6 25
Sheep, common to prime....	3 50	5 00	4 50	6 00	4 50	6 00	4 50	7 00	3 75	6 00
Swine	5 25	5 80	5 50	6 25	5 10	6 00	5 25	6 20	5 25	6 15
CHICAGO.										
Cattle, ex. grad'd steers, 1,400 to 1,550 lbs..cental.	5 80	6 00	5 75	6 25	5 85	6 25	6 15	6 50	6 10	6 40
choice, 3 years old, 1,300 to 1,450 lbs ...	5 30	5 65	5 20	5 50	5 40	5 70	5 65	6 00	5 60	5 85
good, 1,200 to 1,350 lbs.	4 90	5 15	4 75	5 10	5 10	5 30	5 25	5 60	5 25	5 50
med., 1,150 to 1,250 lbs.	4 50	4 75	4 50	4 70	4 75	5 00	5 00	5 25	4 75	5 10
lower grade, natives.	1 75	4 40	1 75	4 00	2 00	4 50	3 00	5 00	3 00	4 25
Texans, ch'ce corn-fed	4 25	4 75	4 00	4 60	4 25	4 75	4 50	5 25	4 00	4 50
Texans, north-wint'd.	3 00	3 75	3 00	3 50	3 25	4 00	3 75	4 25	....	....
Texans, thro'-droves.	1 75	2 75	1 75	2 75	2 00	3 00	2 75	3 50	....	....
Sheep, poor to choice	3 00	5 00	3 75	5 50	4 00	6 25	5 50	8 12½	4 50	8 25
Swine, poor to medium	4 90	5 30	4 80	5 30	4 25	5 00	5 10	5 45	4 50	5 00
good to extra	5 35	5 55	5 40	5 75	5 30	6 30	5 55	6 15	5 50	5 90
SAINT LOUIS.										
Cattle, choice natives, 1,300 to 1,600 lbs..cental.	5 00	5 50	5 75	6 25	5 50	6 00	6 00	6 25	5 75	6 05
prime 2d class, 1,150 to 1,400 lbs.........	4 50	4 75	4 50	5 00	4 75	5 00	5 50	5 75	5 25	5 50
good 3d grade, 1,050 to 1,300 lbs.........	3 50	3 75	3 50	4 00	3 75	4 00	4 25	4 75	4 50	4 75
fair butchers' steers, 1,000 to 1,200 lbs ...	3 25	3 50	3 25	3 50	3 50	3 75	4 50	4 75	4 20	4 25
inferior native grades	2 00	4 25	2 50	3 75	2 50	3 75	2 75	4 50	2 75	5 00
Texans and Cherokees, corn-fattened.	1 75	4 00	2 00	4 00	3 00	3 25	3 50	4 00	3 75	4 75
Texans, thro' droves.	1 50	3 00	1 50	2 50	1 75	3 75	2 00	3 00	2 75	3 50
Sheep	3 75	5 00	4 50	....	5 00	....	2 50	5 60	4 25	6 10
Swine	2 81	5 37½	4 90	5 65	4 90	5 30	5 00	5 25	4 50	5 45
Horses, plugs..........head.	30 00	65 00	30 00	60 00	30 00	60 00	30 00	60 00	30 00	60 00
street-car	75 00	90 00	80 00	90 00	80 00	90 00	80 00	90 00	80 00	90 00
good work..........	80 00	100 00	85 00	100 00	85 00	100 00	85 00	100 00	85 00	100 00
driving animals	90 00	150 00	100 00	140 00	100 00	140 00	100 00	140 00	100 00	140 00
draught animals....	125 00	175 00	125 00	165 00	125 00	165 00	125 00	165 00	125 00	165 00
Mules, 14 to 15 hands high..	60 00	110 00	50 00	100 00	50 00	100 00	50 00	100 00	50 00	100 00
15 to 16 hands high..	120 00	160 00	115 00	165 00	115 00	165 00	115 00	165 00	115 00	165 00
extra	150 00	200 00	150 00	200 00	150 00	250 00	175 00	200 00	175 00	200 00
NEW ORLEANS.										
Cattle, Tex. beeves, ch. head.	....	45 00	45 00	....	45 00	....	40 00	55 00	40 00	55 00
1st quality	35 00	40 00	35 00	40 00	35 00	40 00	35 00	40 00	35 00	40 00
2d quality	20 00	28 00	20 00	28 00	20 00	28 00	20 00	28 00	20 00	28 00
west'n beeves. cental	10 00	12 50	10 00	12 50	8 00	10 00	10 00	12 50	10 00	12 50
milch cows.....head.	35 00	100 00	35 00	100 00	35 00	100 00	35 00	100 00	35 00	100 00
calves	7 00	10 00	7 00	10 00	7 00	10 00	7 00	10 00	7 00	10 00
Sheep, 1st quality	4 00	5 00	4 00	5 00	4 00	5 00	4 00	5 00	4 00	5 00
2d quality	3 00	4 00	3 00	4 00	3 00	4 00	3 00	4 00	3 00	4 00
Swine ....cental.	7 50	8 00	6 00	7 50	5 00	7 00	5 00	7 50	5 00	7 50

OF LIVE STOCK.

as nearly as practicable, at the beginning of each month.

JUNE.		JULY.		AUGUST.		SEPTEMBER.		OCTOBER.		NOVEMBER.		DECEMBER.	
From—	To—	From—	To—	From—	To—	From—	To—	From—	To—	From—	To—	From—	To—
......	$12 75	......	$12 75	$13 00	......	$13 00	$13 25	$12 75	$13 00	$12 30	$13 00	$13 75	$14 00
$11 50	......	$10 25	......	......	$12 75	12 00	12 75	......	......	......	12 00	......	13 25
10 00	......	......	......	10 50	......	10 00	11 75	8 50	......	7 25	......	......	......
......	......	40 00	80 00	40 00	80 00	45 00	85 00	50 00	85 00	40 00	70 00	40 00	70 00
......	9 00	10 00	11 00	7 00	11 00	7 00	12 00	6 00	11 00	8 50	14 00	9 00	11 00
5 00	8 50	4 50	5 50	......	6 50	......	7 50	4 50	6 25	4 50	7 62	4 00	7 50
7 25	7 50	......	5 87½	......	......	7 00	......	6 00	6 75	5 00	6 50	6 75	7 00
5 00	7 75	4 50	7 62	5 50	7 50	3 25	7 50	3 25	7 50	3 00	7 12½	4 00	9 25
5 00	6 75	4 25	6 00	4 50	5 75	2 25	6 00	4 00	6 00	2 50	5 50	......	......
8 75	9 00	8 75	9 00	10 00	10 75	10 00	12 00	11 00	11 50	9 50	10 00	......	......
6 62	7 45	6 00	7 00	5 50	6 62	5 25	6 87	5 00	6 25	4 75	6 25	5 37	6 75
5 75	6 62	4 75	6 00	4 37	5 50	4 00	5 25	4 00	5 00	3 75	4 75	4 37	5 37
5 25	5 75	4 25	4 75	3 75	4 37	3 25	4 00	3 50	4 00	3 00	3 75	3 25	4 37
6 62	......	5 75	......	5 75	......	4 75	......	4 12	......	3 87	......	4 25	......
4 00	6 00	4 00	5 25	2 50	......	......	3 50	2 30	5 25	4 00	5 00	4 00	5 50
7 50	8 25	7 75	8 00	9 50	10 00	10 00	10 25	8 00	10 50	8 00	8 75	8 75	8 95
5 00	5 75	4 25	5 25	4 25	5 50	5 00	5 50	4 50	6 00	4 75	5 00	4 75	5 50
4 00	4 75	3 50	5 00	......	5 00	......	5 00	......	5 00	3 75	4 50	3 50	4 50
30 00	65 00	30 00	50 00	25 00	40 00	25 00	50 00	25 00	50 00	30 00	50 00	30 00	55 00
5 00	7 00	4 50	6 00	4 00	5 00	5 00	6 00	5 50	7 00	5 00	7 00	6 50	8 00
3 75	6 00	3 00	5 75	3 00	4 50	3 25	4 50	3 00	4 50	3 00	4 50	3 25	5 00
5 25	6 15	5 85	6 30	......	7 25	......	7 80	5 40	6 55	5 00	6 10	6 50	7 50
6 15	6 40	6 25	6 50	6 10	6 50	6 40	7 00	6 40	6 70	Nomi	nal....	6 25	6 50
5 90	6 90	5 85	6 10	5 75	6 00	6 00	6 25	5 75	6 00	5 25	5 75	5 50	6 00
5 40	5 70	5 50	5 75	5 25	5 50	5 25	5 75	4 25	5 25	4 00	4 75	4 50	5 00
4 50	5 50	4 75	5 40	4 25	5 00	4 25	5 00	3 75	4 25	3 25	3 75	4 00	4 50
3 00	5 25	2 00	4 75	2 00	4 50	1 75	4 00	2 50	3 50	1 50	3 25	1 75	4 25
4 25	5 00	5 00	5 50	5 00	5 25	4 50	5 25	4 25	4 75	3 75	4 50	4 25	4 50
3 00	4 00	3 50	4 25	3 00	4 25	2 50	4 00	2 00	3 75	1 75	3 50	2 25	4 25
3 00	4 00	1 50	3 25	2 00	4 25	1 50	3 75	2 00	3 75	1 50	3 25	1 75	3 75
3 50	7 25	2 00	4 50	3 00	5 00	3 00	4 75	2 25	4 50	2 50	4 50	2 50	4 50
4 75	5 40	5 30	5 65	6 35	6 65	6 70	6 90	5 00	6 50	5 25	6 00	6 50	......
5 45	5 80	5 85	6 15	6 70	6 85	7 00	8 40	6 60	7 50	6 05	6 40	......	7 50
6 00	6 25	6 00	6 25	5 75	6 00	5 50	5 75	5 00	5 75	5 00	5 50	4 75	5 75
5 00	5 75	5 00	5 25	4 75	5 00	4 75	5 25	3 00	5 00	4 75	......	4 50	......
4 75	5 00	4 10	4 25	3 85	4 00	3 85	4 00	2 00	3 50	3 00	4 00	3 50	......
4 50	4 75	3 50	4 00	3 25	3 75	3 25	3 75	......	......	......	......	......	......
3 00	4 50	2 00	3 75	2 00	2 50	2 25	2 50	......	......	1 00	3 50	2 00	3 50
4 25	5 00	3 00	3 75	3 12½	3 62	3 00	3 50	2 50	4 50	2 00	3 50	2 75	3 50
2 00	3 50	1 25	2 00	2 12½	2 37	1 90	2 20	1 75	2 00	......	......	1 75	2 50
4 00	6 00	2 50	6 00	2 50	6 00	2 00	4 25	2 25	4 25	2 50	5 25	2 25	4 75
4 80	5 60	5 00	6 80	5 50	7 25	4 00	7 50	4 50	7 25	3 25	6 25	5 50	7 50
40 00	75 00	40 00	75 00	40 00	75 00	40 00	75 00	40 00	75 00	40 00	75 00	40 00	75 00
75 00	125 00	75 00	125 00	75 00	125 00	75 00	125 00	75 00	125 00	80 00	110 00	80 00	110 00
80 00	110 00	80 00	120 00	80 00	110 00	80 00	110 00	80 00	110 00	75 00	125 00	75 00	125 00
100 00	150 00	150 00	200 00	100 00	150 00	100 00	150 00	100 00	150 00	100 00	150 00	100 00	150 00
130 00	170 00	115 00	200 00	130 00	200 00	130 00	180 00	130 00	170 00	130 00	170 00	130 00	170 00
65 00	100 00	70 00	135 00	75 00	180 00	75 00	120 00	75 00	120 00	75 00	120 00	75 00	120 00
110 00	165 00	140 00	170 00	120 00	180 00	120 00	165 00	120 00	165 00	120 00	180 00	120 00	180 00
175 00	200 00	165 00	190 00	175 00	200 00	160 00	200 00	175 00	200 00	175 00	200 00	175 00	200 00
40 00	55 00	40 00	45 00	......	40 00	......	40 00	......	40 00	......	40 00	......	40 00
35 00	40 00	35 00	40 00	30 00	35 00	30 00	35 00	30 00	35 00	30 00	35 00	30 00	35 00
20 00	28 00	20 00	25 00	20 00	25 00	20 00	25 00	20 00	25 00	20 00	25 00	20 00	25 00
10 00	12 50	......	......	......	......	......	......	......	......	......	......	......	......
35 00	100 00	35 00	100 00	35 00	100 00	35 00	100 00	35 00	100 00	40 00	100 00	35 00	100 00
7 00	10 00	7 00	10 00	8 00	9 00	7 00	9 00	7 00	9 00	7 00	9 00	7 00	9 00
4 00	5 00	4 00	5 00	4 00	5 00	4 00	5 00	4 00	5 00	4 00	5 00	4 00	5 00
3 00	4 00	3 00	4 00	3 00	4 00	3 00	4 00	3 00	4 00	3 00	4 00	3 00	4 00
5 00	7 50	7 00	7 50	5 00	8 00	5 00	8 00	5 00	10 00	5 00	9 00	5 00	9 00

THE PERSONNEL AND PROFIT OF OUR AGRICULTURE.

In the report of 1873, deductions from census statistics were given, showing the number engaged in the several classes of industry, and the proportion of each class to the total number, by States. It has often been found necessary to make use of a further classification, by which the specialties of agriculture might be investigated. The following table is therefore given, showing respectively the number of farm-laborers, of farmers, of dairymen, of horticulturists, and vine-growers, and also the ratio of farmers and of laborers to the whole number. Of the total number of laborers, 2,885,996, those between 15 and 60 years of age numbered 1,996,886 males and 290,822 females; those under 15, 426,305 males and 73,169 females; and those 60 and over, 89,473 males and 9,341 females:

States and Territories.	Agricultural laborers.		Farmers.		Dairymen and dairywomen.	Gardeners, nurserymen, and vine-growers.	Total employed in agriculture.
	Number.	Per cent.	Number.	Per cent.			
Alabama	208,811	71.6	81,854	28	5	455	291,626
Arizona	585	45.5	647	50.3	5	8	1,265
Arkansas	53,602	49	55,541	50.8	3	125	109,310
California	16,231	33.9	24,061	50.2	1,010	2,648	47,863
Colorado	2,659	41	3,224	49.8	9	28	6,462
Connecticut	18,934	....	23,704	54.3	5	867	43,653
Dakota	308	12.2	2,208	87.5	1	1	2,522
Delaware	8,131	50.9	7,642	47.8	11	126	15,973
District of Columbia	684	50.1	255	18.6	52	347	1,365
Florida	31,033	73	11,165	26.3	17	59	42,492
Georgia	264,605	78.7	70,468	20.9	31	453	336,145
Idaho	720	49.2	629	43	18	8	1,462
Illinois	133,649	35.5	240,256	63.8	99	2,260	376,441
Indiana	83,949	31.4	181,895	68.1	83	790	266,777
Iowa	69,821	33.2	139,478	66.3	51	810	210,263
Kansas	21,714	29.6	50,820	69.4	32	338	73,228
Kentucky	127,911	48.9	131,598	50.4	104	794	261,080
Louisiana	97,783	69.1	41,672	29.4	161	861	141,467
Maine	24,738	30.1	56,941	69.4	3	303	82,011
Maryland	48,079	59.6	31,213	38.8	97	813	80,449
Massachusetts	31,019	42.6	39,766	54.6	14	1,835	72,810
Michigan	64,885	34.6	121,558	64.9	5	636	187,211
Minnesota	20,277	26.9	54,623	75.3	16	200	75,157
Mississippi	181,523	69.9	77,102	29.7	11	332	259,199
Missouri	86,807	32.8	174,961	66.2	385	1,435	263,918
Montana	670	31.7	1,080	51.1	26	14	2,111
Nebraska	5,899	25.5	17,037	73.7	11	79	23,115
Nevada	555	26.8	1,242	....	24	32	2,070
New Hampshire	15,666	33.6	30,749	66	6	119	46,573
New Jersey	29,240	46.3	32,077	50.8	11	1,521	63,128
New Mexico	10,847	58.1	7,629	40.8	3	21	18,668
New York	134,562	35.9	232,649	62.1	384	5,880	374,323
North Carolina	168,978	62.7	98,290	36.5	4	177	269,238
Ohio	191,063	48.1	202,425	50.9	422	2,779	397,024
Oregon	3,126	23.5	9,758	73.6	28	73	13,248
Pennsylvania	68,897	26.4	187,646	72.1	196	2,480	260,051
Rhode Island	5,475	46.4	5,954	50.0	....	332	11,780
South Carolina	163,528	79.1	42,546	20.5	16	108	206,654
Tennessee	136,925	51.2	129,550	48.5	75	426	267,020
Texas	81,123	48.6	79,015	47.3	9	214	166,753
Utah	3,048	29.2	7,044	67.5	17	112	10,422
Vermont	23,692	40.8	34,144	58.8	....	122	57,983
Virginia	162,604	66.4	80,739	33	48	794	244,550
Washington	742	19.6	2,880	76.3	1	27	3,771
West Virginia	30,087	40.6	43,702	59	12	125	73,960
Wisconsin	50,753	31.7	108,240	67.7	25	580	159,687
Wyoming	58	35.1	34	20.6	4	....	165
United States	2,885,996	48.7	2,977,711	50.2	3,550	32,547	5,922,471

In the following table, based upon census estimates of the value of farm productions of 1869, the average earnings of all persons engaged in agriculture in the States respectively are presented:

States.	Number of persons engaged in agriculture.	Per cent. of all occupations.	Value of farm products.	Average for each agriculturist.
Maine	82, 011	39. 39	$33, 470, 044	$408 00
New Hampshire	46, 573	38. 75	22, 473, 547	482 00
Vermont	57, 983	53. 31	34, 647, 027	597 00
Massachusetts	72, 810	12. 55	32, 192, 378	442 00
Rhode Island	11, 780	13. 30	4, 761, 163	404 00
Connecticut	43, 653	22. 56	26, 482, 150	606 00
New York	374, 323	25. 10	253, 526, 153	677 00
New Jersey	63, 128	21. 32	42, 725, 198	676 00
Pennsylvania	260, 051	25. 48	183, 946, 027	707 00
Delaware	15, 973	39. 62	8, 171, 667	511 00
Maryland	80, 449	31. 11	35, 343, 927	439 00
Virginia	244, 550	59. 26	51, 774, 801	212 00
North Carolina	269, 238	76. 64	57, 845, 940	215 00
South Carolina	206, 654	78. 48	41, 909, 402	202 00
Georgia	336, 145	75. 59	80, 390, 228	239 00
Florida	42, 492	70	8, 909, 746	209 00
Alabama	291, 628	79. 84	67, 522, 335	231 00
Mississippi	259, 199	81. 29	73, 137, 953	282 00
Louisiana	141, 467	55. 16	52, 006, 622	367 00
Texas	166, 753	70. 32	49, 185, 170	295 00
Arkansas	109, 310	80. 40	40, 701, 699	372 00
Tennessee	267, 020	72. 56	86, 472, 847	324 00
West Virginia	73, 960	64. 18	23, 379, 692	316 00
Kentucky	261, 080	62. 97	87, 447, 374	335 00
Ohio	397, 024	47. 21	198, 256, 907	499 00
Michigan	187, 211	46. 32	81, 508, 623	435 00
Indiana	266, 777	58. 08	122, 914, 302	460 00
Illinois	376, 441	50. 73	210, 860, 585	560 00
Wisconsin	159, 687	54. 52	78, 027, 032	488 00
Minnesota	75, 157	56. 65	33, 446, 400	445 00
Iowa	210, 263	61. 07	114, 386, 441	544 00
Missouri	263, 918	52. 20	103, 035, 759	390 00
Kansas	73, 222	59. 12	27, 630, 651	377 00
Nebraska	23, 115	52. 72	8, 604, 742	372 00
California	47, 863	20. 05	49, 856, 024	1, 042 00
Oregon	13, 248	43. 22	7, 122, 790	538 00
Nevada	2, 070	7. 69	1, 659, 713	802 00
Arizona	1, 285	21. 31	277, 998	216 00
Colorado	6, 462	36. 75	2, 335, 106	361 00
Dakota	2, 522	42. 84	495, 657	196 00
District of Columbia	1, 365	2. 78	319, 517	234 00
Idaho	1, 462	13. 43	637, 797	436 00
Montana	2, 111	15. 02	1, 676, 660	794 00
New Mexico	18, 668	63. 57	1, 905, 060	102 00
Utah	10, 428	48. 46	1, 973, 142	189 00
Washington	3, 771	38. 63	2, 111, 902	560 00
Wyoming	165	2. 48	42, 760	259 00
Total for the United States	5, 922, 471	47. 35	2, 447, 538, 658	413 00

The usual statistical work, in the form of statements of agricultural production, crop movement and export, and the facts of rural economy generally, has exceeded in volume that of former years, and presses heavily upon the limited clerical resources of the division, which should be materially increased to meet the requirements of the case.

J. R. DODGE,
Statistician.

HON. FREDERICK WATTS,
Commissioner.

REPORT OF ENTOMOLOGIST AND CURATOR OF THE MUSEUM.

SIR: The past season has been marked by more than usual injury to vegetation by insects, and the loss is especially significant because affecting mainly the staple food-crops. Generally speaking, it has been caused by only three or four species of insects, though, of course, all varieties that injure our crops have been more or less active.

In the West and Northwest the grasshopper and chinch-bug have passed through the country like a scourge, leaving, in many cases, only bare fields and desolate homes in their path. In the more eastern States the potato-beetle has made its dreaded presence felt, and, with its usual activity in a new region, has given the farmers plenty to do to save their crops from destruction. In the South the cotton-insects have been comparatively quiet, as the worms were noted in but few localities and not in sufficient numbers to do much damage.

As the Colorado potato-beetle is beginning to be troublesome in the eastern section of the country, and many correspondents, whose farms are attacked for the first time, are asking for information as to the best means for preventing its ravages, we deem it necessary to republish what has been said in former reports regarding its natural history and habits, with the additions of the latest facts on the subject that have come under our observation. This insect has been known for over fifty years, and has been particularly injurious to the cultivated potato since about the year 1860, when it commenced its travels eastward from the base of the Rocky Mountains, and has been steadily progressing since, at the rate of sixty to eighty miles a year. It was, in 1874, destructive in Central New York, Pennsylvania, New Jersey, Maryland, District of Columbia, and Eastern Virginia. It is known as the Colorado or Western Potato-Beetle, or ten-lined spearman, (*Doryphora decem-lineata*,) and its habits are as follows: The eggs are deposited by the female, to the number of about seven to twelve hundred, at intervals, during forty days, on the leaves of the potato, in somewhat regularly-arranged loose clusters. In about six days they hatch into larvæ, which feed upon the foliage of the plant from seventeen to twenty days; they then descend into the ground, and after remaining in the pupa state, to which the larva changes, for ten or twelve days, they again make their appearance as perfect beetles. In about a week the sexes pair, and in another week the females begin to lay their eggs for a second brood, thus requiring but fifty days from egg to egg again. To give some idea of their powers of reproduction the Canadian Entomologist states that if the progeny of a single pair were allowed to increase without molestation for one season, the result would amount to over sixty millions. The insects do not die immediately after laying their eggs, as Professor Daniels, of the Wisconsin University, once kept a female alive six weeks without food, after she had laid twelve hundred eggs.

There is another insect, belonging to the same genus, which is often mistaken for the Colorado beetle. It is, however, easily distinguished from the genuine, as the second and third stripes are always united behind, giving the appearance of a heavy black stripe; and the edges of all the stripes have but a single row of punctures; the legs also have a

black spot in the middle of the thighs. This insect has also been found feeding upon the horse-nettle, (*Solanum carolinense*,) in South Carolina, and has been taken upon potatoes and egg-plants in Alabama, and was particularly injurious to the latter.

In the accompanying wood-cut, (Fig. 1,) 1 represents the true potato-beetle, *Doryphora decem-lineata;* 3, the *Doryphora juncta;* and 2 is an apparent cross between the two, or a variety once found in the South, in which the heavy, thick black line of the *juncta* has a very fine yellowish line running partly through it longitudinally.

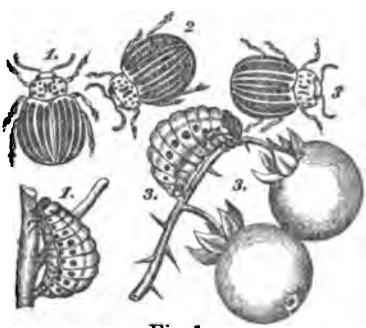

Fig. 1.

The Colorado beetle has a great many foes or parasitic insect enemies that do much toward lessening its numbers and preventing still greater destruction in our potato-fields. It is attacked among the beetles by *Hippodamia maculata*, *H. convergens*, *H. quindecem-punctata*, *Coccinella munda* and *C. novemnotata*, *Tetracha virginica*, *Calosoma calidum*, *Harpalus caliginosus*, *Pasymachus elongatus*, and *Lebia grandis;* among the plant-bugs by *Arma spinosa*, *A. grandis*, *Harpactor cinctus*, *Euschistus punctipes*, and *Stiretrus fimbriatus*. The larva of a parasitic fly, *Tachina doryphoræ*, lives in the larva of the beetle, and the *Polistes rubiginosus* carries it to its nest as food for its young. *Epicauta pennsylvanica* and *Macrobasis fabricii*, both beetles that feed upon the potato, also devour this beetle.

The best remedy that can be recommended is pure Paris-green, mixed with ashes or flour, in the proportion of one part to twelve or fifteen. It should be dusted over the plants in the morning when the dew is on the foliage, and should always be repeated after rains. A convenient way of dusting the vines evenly is to prepare a dredge, on a large scale, from an old fruit-can, by puncturing the bottom full of small holes, and securing to the side a piece of broom-handle about two feet in length. This, when filled, the operator can carry in one hand as he walks down the rows, gently tapping the handle with a similar stick held in the other hand, being careful always to keep to windward. The amount can be regulated by the speed of the operator. Three pounds of Paris-green to about forty pounds of flour, ashes, or air-slaked lime, will answer for an acre of potatoes.

One of our correspondents writes that he has applied Paris-green, mixed with water, sprinkled over the plants with good effect at the rate of one pound to about forty-eight gallons, and seems to think it the best plan, as the dust then cannot be hurtful to the operator.

Mr. Saunders, of this Department, has tried brushing them off of the vines in the heat of the day, and thinks that most of them were destroyed by the operation, and recommends it as the easiest way to get rid of them. We think, however, this remedy would prove of little value in localities where the heat of the sun is not as great as here. Some persons, having a prejudice against the use of Paris-green, recommend hand-picking, or collecting the insects in nets of gauze, and though this may answer in the early part of the season, and do much good by lessening the numbers of the second brood, still it is not practicable or sure later in the season when the insects are very abundant. Insects caught in this manner should never be crushed by the fingers, as they are quite poisonous. Deaths have also resulted from breathing the steam from hot water that has been used to kill them, and also, from carelessly

partaking of food without washing the hands after handling these insects. As the Paris-green is also poison, composed largely of arsenic, great care should be exercised in its use.

As much of the Paris-green that is sold for the purpose of destroying the potato-beetle is impure, and in many instances not Paris-green at all, but chrome-green or imperial green, we give the following test for its purity from one of the Baltimore manufacturers, as follows: Place a small portion of the green in a test-tube, adding a small quantity of water and caustic potash, which will take up all the arsenic, throwing down the oxide of copper; wash this with a little water to free it from the arsenite of potash; then add nitric acid and water, which will dissolve the copper, leaving the adulteration, if any.

The following exhibit of the operations of the insect in different parts of the country is condensed from returns by correspondents of the Department:

The greatest complaints have come from the middle Atlantic States. They were quite severe in Wayne, New York, but were comparatively harmless in Wyoming. In Allegany they were strenuously resisted with Paris-green; they were also noted in Cattaraugus, Delaware, Madison, and Tioga. They were also operating in Gloucester and Burlington, New Jersey. In Butler, Pennsylvania, Paris-green is pronounced a failure; resort was here had to patent preparations, but the most effective method of resistance was to shake the beetles into a box and dispatch them. In Union Paris-green and lime were also effective. In Adams and several other counties the virtues of Paris-green were utilized by a persistent and intelligent application. In Dauphin and Forest the insects departed, leaving no great damage behind them, especially to late plantings. They were more or less injurious in Armstrong, Franklin, Lycoming, Huntingdon, Chester, Philadelphia, York, Perry, Clearfield, Northampton, Washington, Indiana, Lancaster, Beaver, Elk, McKean, Luzerne, and Cameron. Maryland notes their presence in Alleghany, Frederick, Baltimore, Carroll, Prince George, Hartford, and Cecil. They were also in Culpeper, Highland, Fauquier, and Prince William, Virginia; in Harrison, Brooke, Cabell, Hardy, Hancock, Jefferson, Pendleton, and Randolph, West Vrginia. In the last-named county the beetles were destroyed by an insect called the soldier-bug. They injured crops in Lawrence and Bradley, Tennessee, and in Rockcastle, Shelby, Jefferson, Carroll, Harrison, Taylor, Anderson, Lincoln, Grant, Scott, and Spencer, Kentucky. In Ohio they appear to have been less destructive, and more controllable by remedies, especially Paris-green; they are reported in Trumbull, Delaware, Erie, Lucas, Athens, Licking, Meigs, Champaign, Noble, and Columbiana. They are noted in Branch, Monroe, Lenawee, Antrim, Bay, Van Buren, and Menomonee, Michigan, but appear to have been more threatening and troublesome than seriously injurious. In Cass, Indiana, they were perceptibly less numerous under the influence of some insect enemy destroying them; in Marion they were destroyed by the persistent use of Paris-green; they are noted in Elkhart, Clay, Jasper, Harrison, Orange, Marshall, Jennings, Putnam, Wabash, and Perry. In Illinois, parasites of some kind destroyed most of their eggs in Putnam; the beetle was more or less destructive in Cumberland, Hancock, Kankakee, Ogle, Whiteside, Rock Island, Morgan, Marion, Ford, Grundy, Caswell, Macon, Madison, Tazewell, Carroll, Wayne, and Schuyler. A discreet and energetic use of remedies saved the crops in several counties, and limited the injuries in others. In several counties of Wisconsin they were numerous, but here, also, the value of efforts to resist their ravages was illustrated by excellent results. The insects were noted

in Pierce, Greene, Iowa, Dodge, Fond du Lac, Walworth, Clark, Columbia, Douglas, Green, Lake, Door, and Outagamie. West of the Mississippi River they were less injurious. Minnesota reported them in four counties: Ramsey, Chisago, Steele, and Meeker; Iowa in six: Cass, Howard, Clinton, Lamar, Pottawattomie, and Louisa; Missouri in three: Nodaway, Phelps, and Reynolds; Kansas in three: Woodson, Greenwood, and Mitchell; Nebraska in two: Antelope and Thayer. In Mitchell, Kansas, the eggs were destroyed by an insect which, from the description, was probably the lady-bug, (*Coccinella.*) In Shelby County, Kentucky, a novel expedient is reported as successful; fields infested with beetles were plowed up and paddled to destroy the insects with their eggs.

Rose beetles, *Macrodactylus subspinus*, were quite injurious to cultivated grapes in Washington, Kansas.

Curculios were reported as quite destructive in Grainger, Tennessee; Crawford, Ohio; Clarke, Virginia; and Antrim, Michigan.

The past season the western grasshopper, *Caloptenus spretus*, was unusually destructive, entire crops having been swept off in many localities, and the farmer left without means of subsistence. The following accounts from correspondents in Kansas will give some idea of their ravages:

Labette, October.—The farmers in my county had their land for wheat prepared in good time, and in a better condition than I ever saw. On the 6th of September the grasshoppers made their appearance all over the county. Farmers became alarmed and did not sow any wheat. About the 18th to the 20th they appeared to go away. Farmers commenced sowing, and got in about two-thirds of their crop. On the 28th and 29th they came the second time, filling the air, reminding one of a snow-storm in December. Some who had sown early had wheat up nice, but you cannot find a spear in any place. Wheat which was sown before the grasshoppers came the first time has been eaten down, until the grain has finally ceased to grow. I am candidly of the opinion that every acre which is sown to-day in this county will have to be sown again. There is no other chance for it, and the great trouble will be that so many of our farmers have sown all their seed, and are not able to buy again. And what will they do? Some who have not been two years on their claims are leaving them and going over into Missouri and Arkansas to winter—to find something to live upon.

Doniphan, September.—The late summer and fall crops have been almost entirely destroyed by grasshoppers. The common jumping grasshopper did much damage through the early part of the season, but about the middle of August clouds of the flying ones made their appearance over the county, devouring and destroying vast quantities of vegetation. Gardens were quickly eaten up, corn-fields were stripped of leaves, and in many cases the corn was entirely eaten off; fruit-trees are left with naked branches, and in many cases the half-ripened fruit is left hanging on the trees, presenting a sickening sight of death and destruction. In addition to the actual loss by devastation, the loss caused by discouragement will be greater. Years of patient waiting, hard work, and self-sacrifice have been destroyed in a few days, with no known remedy for protection. Just as the fruits of labor were beginning to be realized, destruction came; and the question with many is, "Is it of any use to try again?"

Here is a field for the Department of Agriculture. Some method of protection or relief must be had against the destruction of this insect, or an immense tract of magnificent country will never be what it would without this curse. I am one of those who believe all such things may be controlled by some practical method; it only requires study, enterprise, and means to learn how. This county could well afford to pay $100,000 for a guarantee that no grasshoppers should ever trouble it again. I have learned that vegetation highly cultivated and growing vigorously is less liable to be destroyed than when on the decline or growing feebly. Thus it is we often see a single tree in an orchard eaten even to the bark, while others of the same variety are not damaged so much; and upon examination it will be invariably found that those mostly eaten were diseased, or had their vitality in some way impaired. This thing was noticeable when the same kind of insects were here six or seven years ago. Of all fruit-trees, apple and pear trees suffer the most, while peaches, plums, and cherries suffer the least. They eat the leaves off the apples and leave most of the apples on, but the peaches they will eat and leave the foliage; but, in many instances, when vegetation is not plenty, I understand they clean all as they go, and I have seen instances of this kind. The damage to vineyards in this county is not so great. They do not seem to relish grapes, and are satisfied by eating off the stems and leaving the bunches to fall to the ground. There will not be enough corn in this county to feed what stock there is in the county as it should be fed.

Our correspondence last year forewarned us of a destructive visitation of this pest, from the immense number of eggs deposited during the close of the last season. The severe winter it was hoped had mostly destroyed these eggs, but still countless millions survived in some counties. Many farmers refused to put in crops in the presence of this expected nuisance.

According to July returns, in Wisconsin, they were destructive in Brown, Clark, Door, and Outagamie. Minnesota, however, received the most terrible visitation. In Jackson, while yet too young to fly, the insects destroyed all the grain-crops and gardens. Here they rose in the air during the day-time, and settled upon the crops at night. Their movements were very erratic; they suddenly disappeared, and as suddenly returned. In Faribault they began to wing about June 20, and in two or three days to fly; they always move with the wind, and not over five or eight miles per day. In Cottonwood they swept 95 per cent. of the grain and vegetable crops; thousands of acres of wheat were left perfectly bare. They were first noted here about June 12, 1873, when they remained about two months, laying their eggs and destroying the crops generally; they began to hatch in April, 1874, and began to fly about June 20; every day the air was full of their swarming myriads, but myriads still remained. In Renville, river farms were entirely stripped of wheat; though winging fast, they seemed to recruit full as many as they sent away. In Martin the crops were totally destroyed; correspondents stated that people must have help or they must emigrate. They were also very bad in Lyon, Watonwan, and Rock. In Iowa they ruined the wheat-crop of Harrison as well as the corn and the young apple-trees; in Buena Vista they had just commenced flying, and were seriously threatening the crops; in Carroll a few exhausted pioneers of the main army had fallen, but had not done any damage; they had left Cherokee after doing some injury; they were also noted in Tama, Lyons, Sioux, Hancock, Pocahontas, Emmett, Humboldt, and Webster. Within comparatively narrow range this scourge appears to have been terribly severe.

In August they appeared in Brown and Broome, Wisconsin; Nicollet Sibley, Blue Earth, Faribault, Jackson, Douglas, and Wright, Minnesota; Sioux, Emmet, Harrison, Calhoun, and Woodbury, Iowa; Platte, Shelby, Daviess, and DeKalb, Missouri; Jefferson, Morris, Cherokee, Franklin, Nemaha, Mitchell, Montgomery, Allen, Smith, Bourbon, Douglas, Leavenworth, Cowley, Labette, Osage, Rice, Neosho, Graham, Cloud, Crawford, Ellsworth, Greenwood, Jackson, Butler, Miami, Linn, Pawnee, Chase, Sedgwick, and Shawnee, Kansas; Pawnee, Cass, Nuckolls, Furness, Dawson, Madison, and Gage, Nebraska. In some localities the hot winds, so destructive to vegetation, with the parched earth, addled their eggs. The wide-spread destruction which they have caused in the Northwest has not been adequately described. In many places large masses of people suffered during the winter for the necessities of life, their crops having been swept by this remorseless enemy.

Another species, the common red-legged grasshopper, *C. femur-rubrum*, is reported in several localities in the Middle States, and between the Alleghanies and the Mississippi, but its injuries do not appear very formidable. It was somewhat demonstrative in Delaware and Jefferson Counties, New York, but with slight damage and declining numbers. In Jefferson, West Virginia, they were destructive on young clover; in Fairfield, Ohio, their operations were merely local. They are also mentioned in Livingston, Kentucky.

During the past season an experiment has been instituted in order

to prove the identity of the *Pemphygus vitifoliæ*, or leaf-gall-louse, of Fitch, with the *Phylloxera vastratrix*, or root-gall-louse, so injurious at present to the vineyards in France and in parts of this country also. In March, the Department wrote to Mr. George W. Campbell, of Delaware, Ohio, for specimens of vines infested with the root-gall-louse, *Phylloxera vastratrix*, which he kindly forwarded in most excellent condition for the experiment—the roots being literally a series of galls or knobs, caused by the root-lice themselves living on the roots. These were carefully put in flower-pots and placed in a large closed case, in a leafless condition, so that no other insects could intrude. Three other perfectly healthy vines from our own greenhouses were then planted, on which there were neither leaves nor root-gall-lice, and placed in juxtaposition with the unhealthy vines. These were tended carefully during the summer, put out foliage, and finally all died, with the exception of one vine, apparently from the *Phylloxera*. During all the time the experiment was carried on, the foliage was examined day by day to see if any leaf-gall-lice made their appearance on the foliage, but not the least sign of a gall could be found, even with a magnifier, on any part of the vines, which grew finely until late in summer or early autumn, and put out abundant foliage.

In October, the vines having lost their foliage, the whole six were examined, and the roots were found swollen, as if from the effects of the root-lice, but not a single leaf-gall had been produced on any of the leaves. We cannot give the names of the vines, as accidentally the labels were thrown away by the laborer when he removed the dead vines in order to have them and the earth in which they were grown thrown into the furnace, as is always done when noxious insects are discovered, for fear of dissemination of new injurious insects.

It is also to be remarked that the grape-vines in the immediate neighborhood of the infested plants, in the Department grapery, which were mentioned in a previous report, do not show the least symptom of disease, and appear in a perfectly healthy condition.

As, although this experiment was carefully conducted, there may have been some climatic or other cause which prevented the leaf-galls from making their appearance, from the root-gall-lice known to be there, as it is stated they are identical, we shall repeat the experiment next year on a larger scale, and make the results known to the public.

The chinch-bug, *Micropus* (*Rhyparochromus*) *leucopterus* a former visitant of the Atlantic coast States, appears inclined to renew its old acquaintanceship in that quarter and intensify its injurious presence in the west. Last year it was heard of in only one county east of the Alleghany Mountains—Halifax, Virginia; this year it has again been quite destructive in spring-grain in Nelson, Southampton, Pittsylvania, Albemarle, Gloucester, Louisa, and Campbell, as well as in this county. In Orange it cut down a superior corn-crop to an average. In York it affected early corn, but did not molest late plantings. It was injurious to grain crops generally in Prince William, and in Loudoun ravaged wheat and grass. It was also injurious in Caswell, North Carolina, in Jefferson, West Virginia, and in Harrison, Livingston, Henry, and Graves, Kentucky. It was reported from Athens, Hamilton, and Medina, Ohio; and in Gibson, Grant, Huntington, Madison, Scott, Decatur, Jennings, Wells, Clay, Fulton, Switzerland, Wabash, Warren, Hamilton, Fayette, Carroll, Washington, Pike, Crawford, Putnam, Shelby, Brown, Jasper, Morgan, and Orange, Indiana. In Illinois its destructive sweep was still wider, embracing Menard, Sangamon, Perry, Effingham, Fayette, Jackson,

Clay, Madison, Clinton, Saint Clair, Massac, White, Randolph, Cass, Pike, Logan, Cumberland, Hancock, Macon, Marion, Pope, Mason, McHenry, Crawford, Jersey, Macoupin, Montgomery, Moultrie, Morgan, Richland, Vermillion, Washington, Wayne, Piatt, Schuyler, Shelby, and Edwards. In some counties they appeared early enough to attack winter wheat before harvest, and to make the wheat-stubble a point of attack upon the various spring-sown crops. The drought favored their operations as far north as Wisconsin. Three southern counties, Richland, Jefferson, and Green, reported them as threatening spring crops. In Clarke, Iowa, timely rains largely destroyed the young insects, thus saving the crops from their ravages. They were quite injurious in Jefferson, and less so in Taylor. They were also reported in Shelby, Jasper, and Marion Their most fatal ravages, however, were in Missouri. In Pettis they were so numerous on many farms as to swarm into houses and barns like bees; near wheat-fields the ground was a mass of crawling bugs from noon till near sundown. In Moniteau and Benton they seriously injured wheat on light prairie soils; wheat on timber-land measurably escaped. In Polk, corn-fields adjacent to wheat-fields specially suffered. They were particularly destructive upon grain and grass crops. They are also reported in Lawrence, Caldwell, Cass, Vernon, Saint Clair, Green, Boone, Moniteau, Barry, Barton, Carroll, Cape Girardeau, Christian, Clinton, DeKalb, Harrison, Johnson, Linn, Montgomery, Miller, Phelps, Polk, Ralls, Stone, Randolph, Reynolds, Hickory, Newton, Adair, Franklin, Dallas, Morgan, Laclede, McDonald, Crawford, Clay, Washington, Jasper, Stoddard, Gasconade, Chariton, Nodaway, Dent, and Perry. Kansas reports greater or less injuries in Douglas, Woodson, Allen, Anderson, Barton, Bourbon, Chase, Cherokee, Franklin, Jackson, Lyon, Linn, Montgomery, Miami, Morris, Labette, Brown, Crawford, Woodson, Sumner, Greenwood, Marion, Osage, Wabaunsee, Wilson, Atchison, and Neosho. In Franklin, corn-fields within twenty rods of a wheat-field were considered doomed. No efforts to resist the ravages are reported, nor does any expedient appear to have been suggested in any portion of the country for relief against this very serious and destructive enemy.

A question having arisen as to whether the cotton army-worm, *Anomis xylinæ*, (*Aletia argillacea* of Hübner) passes the winter in the egg, caterpillar, chrysalis, or moth state, Professor A. R. Grote, of Buffalo, at the meeting of the American Association for the Advancement of Science, held at Hartford, in August last, read a very able essay on the subject, in which he stated that he had observed the cotton-worm during five seasons in Central Alabama, and on many different plantations. He states that the earliest period at which he had observed the young worms was the last week in June, and that their appearance was always heralded by the perfect fly, the latter coming to lights in houses at least a week before the worm appeared in the fields; and that the worm is always heard of first to the southward of any given locality. It comes as an army from the south, and the broods arrive consecutively as long as the season lasts, and this southern army is killed by the advancing winter and the death of the food-plant—the cotton-plant—on which it feeds exclusively, refusing to eat anything else. He thinks that the specimens of the fly taken in the Northern States have merely followed the water-courses, as the moths are capable of extended flights; that it originates at the south, and its appearance is due in every instance to a fresh immigration (of the moths) from more southern regions; nay, even farther, Professor Grote concludes that "the insect is not indigenous

with us, but is an annual; not a denizen, but a visitant, unable to contend with the variations of our climate; and he believes that the process of artificial extermination may be simplified by limiting the period of successful attack, and doing away with certain proposed remedies. The agent of destruction must be directed against the first brood in each locality, and concerted action on the part of the planters where the remedy is to be applied will be necessary."

The cotton-caterpillar appeared at different points in the cotton States, but their injuries were scarcely appreciable except at a very few points. In Pamlico, North Carolina, the weather was too cool for them, but generally the extreme heat was unfavorable to their propagation. In Russell, Alabama, and a few other counties, they were somewhat destructive to late crops; but elsewhere they were either of very little force, or were easily destroyed by Paris-green. More or less annoyance is reported in Beaufort and Richland, South Carolina; in Gadsden, Florida; in Coffee, Hale, and Clarke, Alabama; in Cameron and East Baton Rouge, Louisiana. In Hancock, Mississippi, they visited sea-shore fields which had hitherto escaped their ravages. In Bandera, Texas, they ate the top crop.

Canker-worms (*Anisopteryx vernata*) infested a few orchards in Plymouth, Massachusetts. Tobacco-worms (*Macrosila carolina* and *M. quinquemaculata*) injured tobacco in Caswell, North Carolina; Cabell, West Virginia; Adair, Bracken, Grant, Edmonson, and Trimble, Kentucky; Vinton, Ohio. They also attacked potatoes in Antelope, Nebraska, and Barton, Kansas. The white-grub (*Lachnosterna fusca*) injured corn in New London, Connecticut, and Grayson, Virginia. In the last-named county as many as 110 worms were counted in a single hill; they also injured grass-crops; they were more numerous than ever before. They also infested corn-crops in Huntington, Indiana, and in Montgomery, Missouri. Wheat was injured by the midge, (*Diplosis tritici*) in Tazewell, Virginia, and Bracken and Anderson, Kentucky. This pest was confounded with the weavil in Orleans, Vermont. The Hessian fly was mentioned in two or three localities. Our correspondent in Poweshiek, Iowa, says that Paris-green, applied in the same way as to destroy Colorado beetles, will destroy the eight-spotted forester, (*Alypia octomaculata*,) so destructive to the grapevines of the West. This remedy, however, is somewhat dangerous; it may poison the fruit.

ORTHOPTERA.

This is one of the principal orders or great divisions into which insects have been separated by entomological authors, containing the earwigs, grasshoppers, true locusts, katydids, crickets, &c. The name orthoptera is derived from two Greek words, ὀρθός and πτερόν, signifying straight wing, as the generality of insects of this order are distinguished by having their under wings folded in straight plaits, and not doubled up under the wing-cases, as in the coleoptera or beetles. When the insect is at rest the under wings are folded longitudinally, or lengthwise, in long narrow plaits, diverging from a common center at the root of the wing near the body, like a fan; these plaits gradually grow wide as they approach the circumference. When closed, the under wings are concealed under the upper wings, but when in flight they are expanded to the utmost, also in the manner of a fan. The insects of this order are furnished with strong and powerful jaws for biting their food, which consists principally of vegetable substances, leaves, blossoms, and sometimes fruits, and as their digestive organs are also well developed, and

as they feed voraciously in larva, pupa, and perfect stages, the injuries they are able to inflict upon the farmers are sometimes almost incredible. Take, for example, the western grasshoppers, which migrate in grand armies, and sometimes in a single day they will destroy the produce of hundreds of acres. As soon as the eggs are hatched the young insects of this order begin to eat, and are in form almost exactly like the perfect insects, with the exception of having no wings. They shed their skins several times before arriving at maturity; as pupæ they acquire rudimentary wings, or wing-sheaths, and it is only as the perfect insect that they acquire perfect wings and are able to fly. There are, however, several species of the orthoptera which never acquire any wings whatever, but during their whole existence are obliged to leap, walk, or crawl, either wholly wingless, or with rudimentary wings only, which are of no use for purposes of flight.

In this article the order Orthoptera is divided into two sub-orders, namely: I, the false orthoptera, which contains the single family of the earwigs, (*Forficulidæ;*) and II, the true orthoptera, which is divided into three tribes, namely: 1, the runners, or such orthoptera as possess legs particularly adapted for running, (*Cursoria,*) cockroaches; 2, the walkers, (*Gressoria,*) comprising the specter or stick insects and the rearhorses or *Mantidæ;* and 3, such orthoptera as have their hind legs peculiarly adapted for jumping or springing, (*Saltatoria,*) such as grasshoppers, katydids, and crickets. The Thrips, (*Thripidæ,*) the bristle, and spring-tails, (*Poduridæ,*) and the biting bird-lice mentioned afterward, do not properly belong to the orthoptera, but have been merely provisionally placed with them as having their mouth-parts formed for biting and not for sucking, and their transformations being also very similar to the true orthoptera. This classification being, however, somewhat of an innovation upon the present system of classification, if found to be unsatisfactory, can easily be remedied by removing the last three groups or families, *Thripidæ*, *Poduridæ*, and *Mallophaga*, into the other orders, in which they have previously been placed by other entomologists.

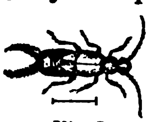

Fig. 2.

The first sub-order, as before stated, contains the earwigs, (*Forficula*, &c.,) (*Fig.* 2,) insects generally of small size, with long, flattened, and narrow bodies, short legs, and short wing-covers, which, when the insect is at rest, conceal a pair of broad, very thin, and transparent fan-like wings, the apical two-thirds portion of which is folded into a very small space, and then transversely folded at the part where the radiating nerves are thickened, and a second transverse fold occurs at the extremity of a leathery patch on the wing. Their colors are generally obscure, being brown or blackish. The most distinguishing feature by which these insects can be most readily recognized is a pair of horny forceps or pincer-like appendages with which the end of the abdomen is armed. In habits, earwigs are nocturnal, hiding in crevices, under dead leaves, stones, or clods of earth during the day, and issuing from their retreats in the evening and during the night, to feed upon either vegetable or animal substances. The females of some species of earwigs in Europe are said to possess a great deal more maternal instinct than is usual with other insects, inasmuch as, after her cluster of little oval eggs has been deposited under a leaf or stone, the female collects them together and nestles upon them as a hen does on her eggs, and probably also feeds and protects her young. To counterbalance this good trait of the mother insect, it is also stated that the young will devour the bodies of their dead brethern, and even feed upon the mother herself, if she happens to be killed on or near the nest. Curtis says that earwigs may

not only injure the crops by eating the young plants as they shoot from the ground, but also probably injure grain by feeding on the pollen. They are very injurious in Europe to the corolla of flowers and to fruit, such as grapes, peaches, &c., especially if they are ripe and have been somewhat bruised, when they eat large holes, totally ruining them for the table, and yet these insects are somewhat beneficial by destroying and eating the wheat-midge, thrips, and plant-lice, but 'it is somewhat doubtful as to whether the benefit we derive from their carnivorous propensities are not more than fully counterbalanced by the injuries they do to crops. As these insects are nocturnal, and hide in hollows and crevices during the day, advantage has been taken of their habits to devise means for their destruction. In Europe, crabs' or lobsters' claws, or other hollow substances, such as tubes of stiff paper, pieces of reeds, or any other hollow-stemmed plants, are hung up, or laid in such places as they frequent, and as soon as daylight appears the insects crawl into them to hide for their day's sleep, when they can readily be shaken or blown out into hot water, and thus destroyed. Poisoning them with arsenic, Paris green, or some other deadly poison, mixed with mashed potatoes or spread on decaying fruit, will kill many, but should never be used, as it is a very dangerous remedy, and may prove fatal to fowl or even mankind, if the poisoned insects fall into vessels containing food or liquids. In some bottles of sweetened water hung up for the destruction of wasps several earwigs were found, and perhaps such bottles might be used with advantage when the insects are very destructive. Although these insects are said to be very numerous in England, and do great injury to the wall-fruits, &c., we are happy to say that in the United States they are comparatively rare, the dry, or rather hot, atmospheres of our summers not agreeing with their habits or constitutions. The common name of earwig is derived from the superstition that these insects crawl into the human ear and cause deafness, and sometimes even delirium; but this idea has been exploded. If by chance a stray earwig crawls into the ear of a person lying on the grass, injections of oil and warm water will soon destroy the intruder.

Suborder II consist of the genuine orthoptera, which, as before stated, are divided into three tribes, from their general mode of locomotion, namely, the runners, (*Cursoria*,) the walkers, (*Gressoria*,) and the jumpers, (*Saltatoria*.) Tribe 1 of the *Cursoria* or runners contains all the cockroaches, (*Blattidæ*,) the insects of which have legs formed for running, and, armed with spines, their bodies are generally broad ovate and depressed; the antennæ are long and thread-like, the fore wings are leathery or parchment-like, and the hind wings are folded under the upper wings in longitudinal folds, excepting the anterior third, which is flat. Some species, however, have merely rudimentary wings, and are incapable of flying at all. The eggs of cockroaches are not laid separately, as with the majority of insects, but are collected together and deposited at once in a large horny capsule or egg-case, variable in shape in the different species, but generally in the form of a small bean. Each egg-capsule is divided into two spaces, each of which is formed of a row of separate cases, each case inclosing a single egg, and the female cockroaches may be seen running about each with this bean-like capsule protruding from the end of its abdomen. The egg-cases themselves are frequently found dropped in the corners of drawers or crevices of chests, floors, or boxes; these should always be thrown immediately into the fire or crushed under foot, as, if left undisturbed, they will hatch out in a few days, and the young cockroaches will disperse over the whole wardrobe. As larva, pupa, and imago these insects are equally destructive.

Roaches, as these insects are sometimes called, are generally nocturnal in habits, and hide in corners and crevices during the day, but at night they emerge from their retreats to feed. They devour both animal and vegetable substances, and not only eat books, clothing, paper, leather, &c., but they also render the substances over which they run filthy and disgusting by discharging from the mouth a dark-colored, nauseous-smelling liquid. There are some few parasitic insects which destroy them both in the egg and insect state, but they are too few to be of any practical benefit in lessening their numbers. One of our most plentiful and destructive species is the "croton-bug," or German cockroach, (*Ectobia germanica.*) This is a medium-sized or rather small cockroach, generally of a light yellow or deep-fawn color; both sexes are provided with wings, and are sometimes, in summer, found under the bark of trees in Maryland. These insects are especially destructive and abundant in houses heated by means of hot-water pipes, as they seem to thrive best and multiply most where there is a combination of heat and moisture. They are almost omnivorous, and actually once made a raid on a box of water-colors, where they devoured the cakes of paint, vermilion, cobalt, and umber alike; and the only vestiges left were the excrements in the form of small pellets of various colors in the bottom of the box. Some years ago, in a library, we tried to poison these insects with red lead, Paris green, &c., mixed with glycerine and other substances. The Paris green certainly did kill them, but the edges of the books were so much stained with the green excrement as to be almost ruined. Colored arsenical poisons should therefore be carefully avoided, if it is desired to keep the books and papers clean and neat.

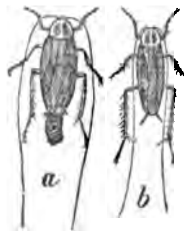

Fig. 3.

Another very troublesome species is the oriental cockroach, (*Stylopyga orientalis.*) This is a very large and common species, and is generally found most abundant in or near seaport towns. This insect is generally supposed to have been imported from India. It varies in color from chestnut to almost black, according to age and exposure. The wings of the males are much shorter than the body, while the wings of the females are wanting, or are very rudimentary. They are very fond of heat, and hide in cracks near furnaces and fire-places. Their general habits and the manner in which the eggs are deposited are much the same as with the croton-bugs. The injury these insects do when numerous is very great, as they are almost omnivorous. There are several other genera and species of cockroaches in this country, but they all have very similar habits to the above, and are neither so plentiful nor do so much injury; some of them live in old rotten wood, under bark of trees, and live altogether out of doors, and therefore the injury they do to farmers or housewives is very trifling or of no consequence whatsoever. In order to destroy cockroaches, several traps have been invented, one of which consists of a wooden or tin box, having its ends sloping to the ground and roughened so as to afford a good foot-hold to the insects when ascending. The inside of the box is previously baited with bread and molasses, or some other sweet or highly-scented food. In the center of the top of this box is a small circular hole sloping inwards in the form of a funnel, which is made of tin, glass, or some

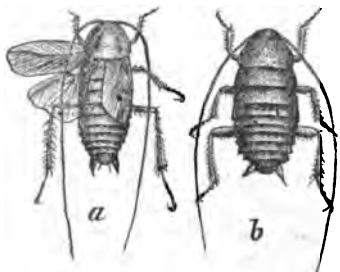

Fig. 4.

other smooth and slippery material. The cockroaches, attracted by the smell of the food, ascend the inclined plane to the top of the box, and readily fall through the hole in the center into the body of the box; and once in are unable to get out again. A shallow tin funnel inserted in the top of any common box will answer the same purpose, provided it can be made to open either at the top or sides, so that the bait can be introduced, and afterward to remove the dead insects after they have been scalded, and, instead of the inclined plane, pieces of rough lath may be laid against the sides of the box, up which the cockroaches can readily ascend; attracted by the feast below, they fall in and are drowned in the adhesive mixture, which clings to their wings and legs. Dr. Harris and others recommend poisoning the insects with red lead and molasses, but this remedy did not succeed with us. Mashed potatoes or scraped carrots mixed with arsenic was very effectual in killing them. Paris-green is mentioned in the American Agriculturist of 1862 as affecting insects when dusted in their runs; but when tried by us in the library, as before mentioned, seemed to have a laxative effect, judging from the soiled and spotted appearance of the books a few days after using. Insect-powder made from the *Pyrethrum* strewed in their haunts for a time was of utility; but we found that this powder must be perfectly fresh to have any effect, as it loses its power if exposed to the air for any length of time. Feverfew, and even chamomile flowers, if pulverized when dried, and perfectly fresh, have a somewhat similar effect, and appear to be very distasteful to them if dusted in their haunts; but powdered borax, once so highly recommended, did not appear to affect them in the least. Arsenic, mixed with mashed potatoes, certainly was the best poisonous remedy we tried, and the earthenware glazed basin, partially filled with molasses and water, was the cheapest trap. Dr. Renner, of Maryland, in a communication to the Department, states that the root of the poke-weed, (*Phytolacca decandra*,) in either a fresh or dried state is poisonous to cockroaches, and that he and his neighbors have used it with good effect.

The second tribe of true *Orthoptera* consists of such insects as have their legs peculiarly adapted for walking, (*Gressoria.*) It consists of two families, viz, the rearhorses or *Mantidæ*, and the specters or walking-sticks, (*Phasmidæ.*) The rearhorses, camel-crickets, or praying mantids, as they are variously known, are all of them beneficial to the agriculturist, as they destroy all other insects they can catch and overpower.

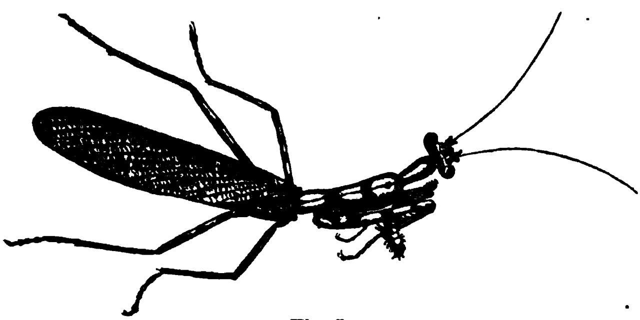

Fig. 5.

They are very well represented in this country by *Mantis carolina*, which is very common in the autumn in the neighborhood of Washington. These insects, when fully grown, are of a large size, of a greenish or grayish brown color. Their heads are horizontal, their eyes large and

globular, antennæ thread-like, and the body long, linear, and oval, with the abdomen much wider than the thorax or front part of the body, and of a depressed form. The upper wings of the male are long, and have numerous veins. The under wings are thin and net-veined with long parallel veins. The wing-covers of the females are considerably shorter than those of the male, and do not reach the end of the abdomen. When disturbed, this singular insect elevates or rears the fore part of its body almost perpendicularly, fixes its large staring eyes full upon the disturber, and turns its head sideways in a peculiarly human, yet ludicrous manner, so as to follow every movement of its tormentor with at least one eye. If a small object, such as a blade of grass, be then presented, it will either strike out vigorously with its saber-like fore feet, or else retreat to what it considers a safe distance.

These insects are especially remarkable in the formation of their fore feet, which are much longer than the others, and are formed particularly for catching and holding their prey, which consists of other insects. The thighs are robust, and armed with a double row of spines, the shanks are short, spiny, and curved so as to fit into the under side of the thighs, when closed, like a clasp-knife. When in pursuit of its prey the insect moves almost imperceptibly along, and steals toward its victim like a cat approaching a mouse, and, when sufficiently near, the fore leg is extended at its full length, the insect immediately caught and impaled by the spines between the thigh and shank, carried to the mouth, and deliberately eaten piecemeal while yet alive and struggling to escape. If gently treated and daily accustomed to the sight of its feeder, this insect may readily be tamed so as to take flies from the hand, and from the oddity of its actions and apparent intelligence makes a most interesting pet. The eggs are clustered together in an irregular brownish mass or case, about an inch long, and fastened to the branches or trunks of trees, on palings, or walls, and even on the under side of window-sills, in Washington, where the insects are very common. Wherever such cases are found, they should be protected and not destroyed, as is generally the case, (being mistaken for the eggs of leaf-destroying caterpillars,) as the insects produced from them do no injury whatsoever to vegetation, but, on the contrary, are very beneficial as destroying injurious insects, from their earliest infancy, as when young they feed upon plant-lice and other minute insects. These young rearhorses are so carnivorous that almost as soon as they are hatched and their skins a little hardened by exposure to the atmosphere they will devour their younger and softer-bodied brethren, and we have seen frequently a young mantis of a day old mercilessly devour his young sister or brother just emerged from the egg-case. When older, these insects disperse and feed at first on very small insects, such as plant-lice and similar small game, until they acquire size and strength sufficient to master small caterpillars and flies. When fully grown, the females, being much larger, stronger, and more rapacious than their mates, the males, will frequently seize and kill them, and afterward make a good meal from their quivering bodies.

Family 2 contains the specter or walking-stick insects, *Phasmidæ*. These insects in this country do very little, if any, injury, to the farmers, as they generally live on the shoots and foliage of wild shrubs or trees in the woods. The most common species is the common walking-stick insect, (*Diapheromera femorata*,) so named from the close resemblance the insect bears to a dead twig or stick. The egg-sack is said to be flattened, elliptic, with a lid in front, which can be pushed open by the imago when about to hatch. These eggs are deposited in autumn. The young insects resemble the old ones in form and habits, differing

only in size. The species never acquire wings, and merely walk or crawl from limb to limb; they are of very sluggish habits, and the males are considerably smaller than the females. When stretched out

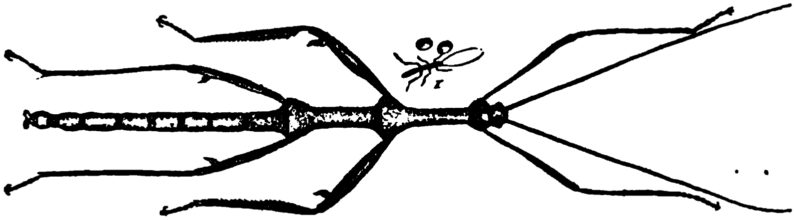

Fig. 6.

motionless on a twig, with fore feet and antennæ extended, they can scarcely be distinguished from the twigs themselves, and city visitors, who see them for the first time, can scarcely be persuaded that they are not real twigs, gifted in some mysterious manner with life and motion.

These insects are said to be able to reproduce some of their limbs, when accidentally broken off. They feed upon the buds, shoots, and foliage of various trees and shrubs, but are not sufficiently numerous to cause much injury.

Tribe 3, the leapers, (*Saltatoria*,) includes such orthopters as have their hind legs formed for leaping, as the grasshoppers and crickets; it also includes one subfamily, which is an exception to this rule, as their hind legs are not particularly formed for leaping, namely, the male crickets, concerning the structure and habits of which we will speak hereafter. The tribe *Saltatoria*, or leapers, is again subdivided into three families. The first of these is the *Acrydidæ*, which includes the grasshoppers, true locusts, and the small so-called grouse-locusts, so common in some eastern meadows. It must here be observed, however, that the insects generally, yet erroneously, called in the United States locusts, and which are so plentiful on our shade-trees in autumn, making a peculiar shrilling noise, are properly not locusts at all, or in any way allied to the scripture locust, and are not gregarious or migratory in their habits.

Almost all the family of the *Acrydidæ* feed more or less on grass and herbage in general. Among them we find the true locust of the Bible, our common red-legged field-grasshopper, the migratory grasshopper of the West, and the small grouse-locusts or grasshoppers.

In regard to the locusts of the Bible, it appears to be now generally conceded that there are at least three or four species which are migratory in the Old World, and have been confounded together by various writers, as they all are migratory in their habits and at times exceedingly destructive. One of these is the *Acrydium peregrinum*, which is mentioned by Olivier as occurring in immense swarms in Syria, but is not thought to be the genuine Bible locust. It is found in Egypt, Arabia, Persia, Senegal, &c. The second species is *Acrydium tartaricum*. This species is also migratory, and occurs throughout South and Southeastern Europe. It has also been taken in Algeria, France, Germany, Hungary, Italy, Spain, Tyrol, &c. The third species is *Pachytylus migratorius*, (Fig. 7,) and is now generally supposed to be the true locust mentioned in the Bible. These insects are produced in immense numbers, and keep together in an imperfect state of society, and when fully grown take flight in immense swarms into adjoining districts, where they destroy every green thing they can find, frequently causing famine and

starvation by devouring the crops, and in some cases disease and even death, by dying and putrefying in immense masses. Kirby and Spense mention many instances of their ravages, and the large swarms in which they migrate from place to place. In several countries these locusts are used as an article of food, and there is very little doubt but that these insects constituted the food of John the Baptist.

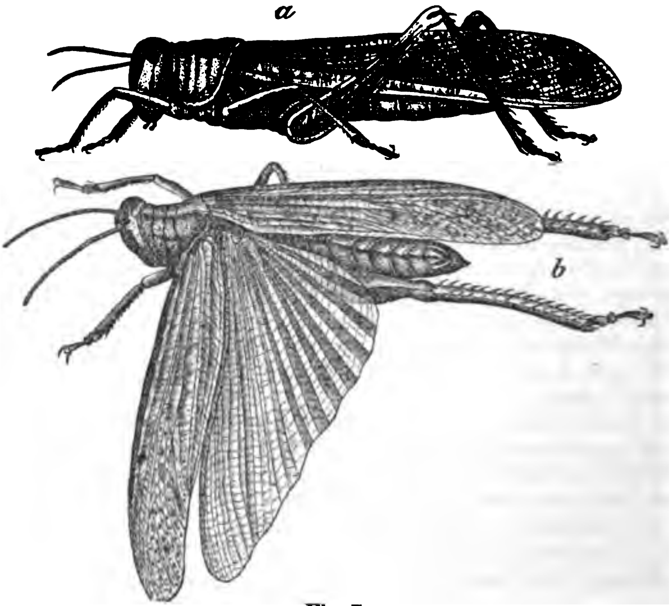

Fig. 7.

Professor Thomas thinks also that *Pachytylus* (*Œdipoda*) *migratoria* is the locust of the Bible as mentioned in the book of Joel, from the fact that the genus *Œdipoda*, when stridulating or making its shrilling noise, produces a sharp, crackling sound like the burning of stubble.

In the United States we have two species of real migratory grasshoppers or locusts, which collect together in immense numbers and migrate in search of food or places in which to deposit their eggs. The most plentiful and destructive species east of the Rocky Mountains is what

Fig. 8.

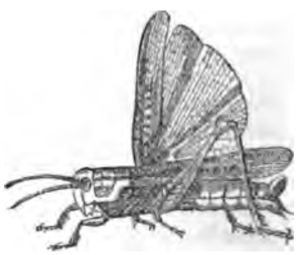

Fig. 9.

is generally known as the Rocky Mountain or "hateful" grasshopper, (*Caloptenus spretus*,) (Fig. 8.) This insect resembles our most common eastern species, the red-legged grasshopper, (*C. femur-rubrum*, Fig. 9,) so very abundant in fields and meadows, and which it exactly resem-

bles in form, size, color, and markings, and differs merely in having its wings and wing-covers a fourth to a fifth longer, which enables it to fly to much greater distance than our common eastern species. The western migratory grasshopper deposits its eggs generally on gravelly terraces or uplands and in the narrow cañons of the moderately elevated mountains, and appears to die out after a season, if bred in the lowland countries. They are exceedingly numerous and destructive in the Western States, frequently devouring whole crops in the course of a few hours, and when all vegetation in one place is consumed, they migrate to another region where food is more abundant. When young they are unable to fly, and devour whatever crops are in their immediate neighborhood. Professor Brewer, in the American Naturalist, vol. v, p. 220, states that "the grasshoppers (*C. spretus*) are exceedingly abundant in Colorado and range high up in the mountains, at an altitude of 13,000 feet," and that "if they chance to alight or fall on the snow they soon become chilled and perish there in numbers that challenge belief until seen, and it is no exaggeration to say that tons of them may be seen, and that when the large snow-banks melt in summer the number of dead grasshoppers left on the rocks is so large that the stench caused by their decay pollutes the air to a great distance." These insects are found in the Western States, Colorado, Nebraska, Kansas, &c., and Professor Thomas says he has traced this species from Texas northward to the north shore of Lake Winnipeg, and from the Mississippi River westward to the Sierra Nevada range. Our common red-legged grasshopper (*Caloptenus femur-rubrum*) of the Eastern States is also sometimes very numerous and troublesome in gardens and meadows, but when they are disturbed they fly but a short distance and alight, but may be driven out of one field into another, like a flock of turkeys, it followed up by a line of men or boys.

The most destructive species of grasshopper in California is said to be what is commonly known as the "terrible grasshopper," (*Œdipoda atrox*.) This appears to be the insect which has ravaged the cultivated districts of Oregon and California and the neighboring States and Territories. It probably ranges over the whole extent of country west of the Rocky Mountains, and included within the limits of the United States. Professor Thomas remarks, in his work on the *Acrydidæ*, "I am half way inclined to the opinion that future investigations will show that *Caloptenus spretus* (the Rocky Mountain or hateful grasshopper) is really the destructive species in California, and not *Œdipoda atrox*, as it would seem impossible for the latter to sustain itself, during a lengthened flight with its short wings." As all the grasshoppers or locusts have somewhat similar habits, the same remedies will do for all, when in fields or gardens in moderate numbers; but when they come by millions, like the migratory species, it is almost impossible to devise any means to destroy them or prevent their ravages.


Fig. 10.

Mr. James W. Taylor, United States consul, has written a long and interesting article on the western migratory locusts or grasshoppers in a newspaper called the Manitobian, published in Winnipeg, province of Manitoba, August 22, 1874. In this paper he enumerates the remedies suggested, and gives many new facts and data, and states that these insects were especially numerous in Minnesota in the years 1856, 1857, 1865, 1873, and 1874, and in each case they caused a loss of one-tenth of the crop of that State. In the Red River settlements these migratory

locusts appeared in 1818, 1819, 1857, 1864, 1867, 1869, 1872, and 1874. A species of grasshopper was very destructive in California in 1828, 1838, 1846, and 1855. In 1856 they appeared in Texas, Kansas, and Minnesota, and in 1866 Kansas and the western districts of Missouri and Iowa suffered greatly from a destructive species of grasshopper locust.

For the destruction of these insects, plowing deeply where the eggs are deposited is said to be useful, and harrowing over the fields will tear up and expose the eggs to the drying influence of the sun and air, thus destroying the embryo insects and preventing the eggs from hatching in the spring. The practice of burning the prairie and herbage in the autumn is condemned, while burning in the spring, in circles, when the young grasshoppers first appear, is highly recommended, as the insects, not being able to fly, will be driven to the center by the heat and smoke, and perish by millions. Rolling the fields in spring, early in the morning, when the young wingless insects are thoroughly chilled by the cold nights, is said to be of utility; and when the winged insects alight on a field of grain, a rope drawn over the heads of the grain is said to have been used with advantage in saving a part of the crop, as the insects are thereby knocked to the ground. Mr. Taylor likewise states that the pea seems unpalatable to the grasshoppers, and suggests that fields of wheat shall be surrounded by a margin of the field-pea, say 100 feet in width, and that open prairies be protected from fires in the autumn, and burned systematically in circles in the spring, as before stated, as soon as all the young are hatched out. When the insects themselves are migrating or on the wing in search of food, burning anything that will create a dense smoke is recommended, the fires to be kindled to the windward side of the field to be protected.

Among the enemies or parasites that aid in lessening the numbers of these migratory locusts is a species of *Pimpla* which is said to destroy the eggs in the egg-sacks, and the western farmers have reported that a small red insect (probably *Astoma locustarum*, a species of red mite) is very useful in destroying them, these mites being found clustered on the body of the grasshopper or under the wing. When the grasshoppers are newly killed or alive they are greedily eaten by hogs, poultry, turkeys, &c.

It has been suggested that these insects have increased in numbers very much since the disappearance of the buffaloes on our western plains, as the eggs and young are most numerous in the paths worn by that animal, and would necessarily be destroyed by the vast herds trampling upon them in their migrations. As the migratory western grasshoppers occur in such vast numbers in certain localities, and can be taken in such immense multitudes, it is possible that some enterprising individual may find out a means of making them useful to mankind and of utilizing them either as a substitute for guano or manure, or of drying them as food for fowls, hogs, &c. In Europe, during the cockchafer season, a kind of oil was expressed from the bodies of the captured insects, and possibly some use may yet be made of the vast swarms of locusts or grasshoppers that now devastate our western plains and destroy the hopes of the western husbandmen. The suggestion has merely been mentioned to induce some of our chemists to make experiments in utilizing the insects, and should they succeed in making a profitable article of what has been hitherto a great injury to the farmers, they will deserve the gratitude of the whole country.

A planter in Texas writes that "as soon as the grasshoppers have laid their eggs, let the planters plow their fields and turn the soil over,

and thus destroy the spring crop of grasshoppers. This experiment has been made on small spots of ground where myriads of eggs were deposited, and not a grasshopper came from under the layers of earth that covered the eggs." This may, perhaps, prevent the spring or young crop of grasshoppers from injuring the crops in the neighborhood of their birthplaces, but as the western or migratory Rocky Mountain species deposits its eggs principally in sandy, rocky, and desolate places, this would not do much to prevent the main migratory swarms that do so much injury later in the season.

If the eggs of grasshoppers are deposited in grassy prairies, it will do very little good to burn off the dry grass in the autumn, to destroy them, as the eggs are deposited too deep in the ground to be injured by a fire passing swiftly over them, but if the burning be delayed till spring, when the young insects are hatched out and as yet unable to fly, and there is sufficient of old dry grass to burn, myriads might be destroyed by burning the old stubble, from the outside of a large circle to the center, so as to drive all the wingless insects to the middle, where the fires meeting would infallibly destroy all the locusts within the circle. In Europe the eggs of certain grasshoppers, which are deposited in the ground in little masses covered with a sort of gum, are dug up by the peasants, and rewards are given at various rates for the eggs by the authorities in power. Grasshoppers, when in fields, may be taken in great numbers by means of a stout cloth carried by four persons, two of whom draw it rapidly along so that the edge may sweep on the surface of the earth, while the other two hold up the cloth at an angle of 45 degrees. Horse-power might, perhaps, be used to advantage if a proper and suitable machine or frame were made on this principle, with or without small wheels, and having the frame made so as to extend the cloth in order to sweep up the flying insects. Harris, indeed, recommends two sheets attached together and fastened to a pole, which is used as the front part of a drag. The pole extends some distance beyond the width of the sheet, so as to admit persons on both sides to draw it forward; at the sides of the drag, braces extend from the pole to raise the back part considerably from the ground, so that the grasshoppers cannot escape. After running the drag about a dozen rods with rapidity, the braces are taken out and the sheets doubled over; the grasshoppers are then swept from each end toward the end of the sheet where an opening is left to the mouth of a bag, which holds about half a bushel. When deposited and tied up, the drag is opened and ready to proceed again. When one bag is filled it can be emptied into a larger one, and the insects may be killed by dipping the larger bags into boiling water, and, when boiled, they make good food for hogs. This drag can only be used in the evening when the insects are perched on top of the grain. When on salt-marshes, the same author recommends mowing about the first of July, so that the young grasshoppers, being wingless at that time, cannot migrate, and will perish for want of food, and at the same time a considerable crop of hay will be saved. A very useful small hand-sweep, or scoop-net, or bag for catching grasshoppers or other insects, was mentioned in the report of the Department for 1867, page 64; such a bag may be made by procuring a hoop of the size required, of either wood or iron, with a wooden handle of any length desired, then causing two stout linen or cotton conical bags to be made to fit on the hoop, the inner one being somewhat shallow and having a hole in the center of the conical end, with a tin or iron circlet or funnel. The outer bag is the same size at the circumference, but is much longer and deeper, with likewise a hole at the end, which may be tied up

with string. With such a sweep-net the hoop is swept from side to side, but always turned so that the insects are swept into the open mouth of the shallow bag, from whence they are shaken through the funnel into the cavity or space between the outer and inner bag, and not being able to escape out of the same hole through which they were shaken into the outer bag, are confined until emptied into other bags or into receptacles of boiling water. The tin funnel-shaped hole in the center of the first shallow bag can be stopped up with a cork if desired, and the hole in the outer bag can be tied with a string. The advantage of such a scoop, or sweep-net, is, that the insect once in the second bag cannot escape, whereas in an open scoop-bag, such as is generally used by entomologists, many of the insects escape before they can be transferred into proper receptacles. A larger scoop-net, made on the same principle, might be used in meadows for grasshoppers. In many places deep ditches are dug into which the wingless larvæ and pupæ are driven, before they are able to fly, and when thus collected together, light brush or straw is thrown over them and then set on fire. In case ditches are made, it is advisable to dig them wider at the bottom than at the top, so that the sides shelve inward toward the bottom, somewhat like an inverted cone, so that the insects will not be able so readily to crawl out, as if the sides were sloping outward at the top or like an inclined plane.

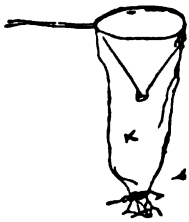

Fig. 11.

When grasshoppers appear in such multitudes as they frequently do in the West, it is an almost hopeless task to try to exterminate them, for if driven away or destroyed one day, fresh hordes will probably appear on the next, to consume what little the first swarm have spared, and as the migratory species lays its eggs and breeds in barren places or in uninhabited cañons, it appears to be almost impossible to destroy them. Unfortunately, also, grasshoppers appear to be infested with very few parasitic insects, or at least with such as would materially lessen their numbers. Turkeys, ducks, fowls, &c., are very useful by destroying them, and a large flock of turkeys will soon clear a field of these pests. Insectivorous birds also devour great numbers. In an old note-book we find that in the month of March, in Maryland, we once shot a blue-bird with two very large grasshoppers in its stomach, although at the same time not a single grasshopper could be found in the same field by a most diligent search. In autumn also we have shot several of the smaller species of hawks with their stomachs literally filled with nothing else but a mass of half-digested grasshoppers which they had caught in the field. Rolling grass-land in spring, early on cold wet mornings, when the insects are thoroughly chilled and before the young grasshoppers are able to fly, will aid materially in diminishing their numbers, but if done after the sun is up and the temperature becomes warmer, rolling will be of very little use, as most of the insects will then contrive to escape being crushed by the roller.

Family 3, *Locustidae*, contains the katydids, the slender meadow-grasshoppers which live on the ground or in caves. The katydids (Fig. 12) live on trees and shrubs, where they eat the foliage; the males making a curious shrilling noise in the evening and during the night which resembles the words "Katy did." The eggs of some of these insects are deposited in a double row on twigs and leaves, and appear like small flattened gray hemp-seeds, lying one partly over the other. Some species, however, are said to deposit them singly in leaves, &c. These insects are not often found in such numbers as to do much injury to veg-

etation, and as they confine themselves principally to forest-trees, are of very little consequence to the farmer. Many of these insects bear such a striking resemblance to trees, both in form, neuration of wings, and color, that it is exceedingly difficult to distinguish them when amid the

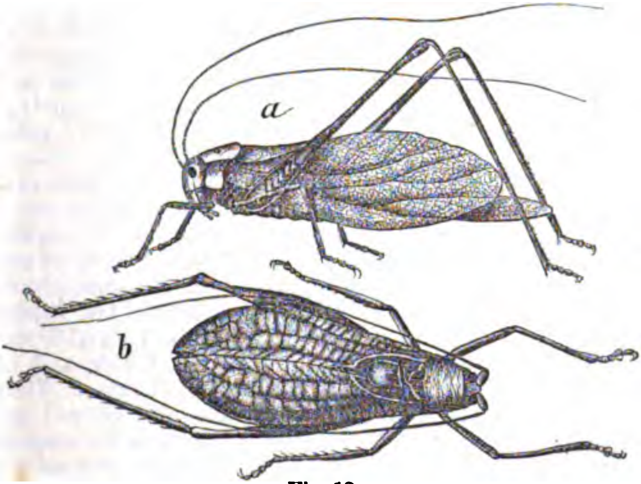

Fig. 12.

foliage; many of the females are distinguished by having long straight or curved sword-like ovipositors at the end of the abdomen. The slender meadow-grasshoppers (*Orchilemum vulgare*. Fig. 13, &c.) are of a more slender form than the true locusts or common grasshoppers, and are distinguished also from them by their long slender thread-like antennæ, and their long and attenuated hind legs; they live in grass and herbage, and should they prove troublesome, the same remedies will apply for them as have been recommended for common grasshoppers and locusts; many of them are of a greenish or brownish color, and the females have long ensiform ovipositors, which they use to deposit their eggs in the earth.

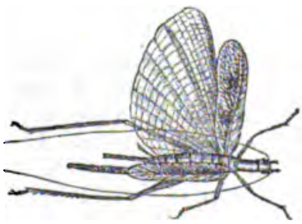

Fig. 13.

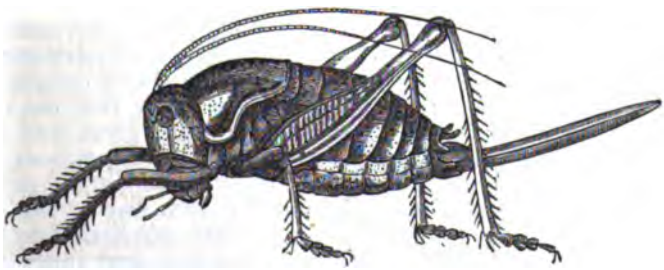

Fig. 14.

The large wingless crickets, or grasshoppers, (*Anabrus simplex*, &c.) generally live on the ground, or on low growing plants; some are found in caves or under stones, while others are found on wild grasses and herbage. Some species are found in immense numbers on the western plains, where they feed upon weeds or any green plant that may occur in their vicinity. In the Eastern States many species inhabit woods or dark, damp places, and, if disturbed, hide under stones or

rubbish; they are, however, at present not known to destroy the crops to any considerable extent; and if they do, the same remedies may be applied as above. These larger wingless crickets or grasshoppers are generally of dull, obscure colors, as gray or brown, the color of the ground or stones they frequent, and seldom if ever exhibit the bright green colors of their winged relatives the katydids which live amid the foliage of trees and shrubs; many of the females also possess long ensiform ovipositors which they use to deposit their eggs deep in the earth.

Family 4, the *Grillidæ*, contains two subfamilies, namely, the tree-crickets and flower-crickets, and the mole-crickets. The true crickets have the antennæ long, slender, and thread-like; their color is mostly brown or black, their heads are large, the wings of moderate length, and the hind legs are formed for leaping. The females are furnished with a long ovipositor, for depositing their eggs in the earth. In the evening the males make a thrilling or creaking noise by rubbing their wing-cases together. The common house-cricket *(Gryllus, (Acheta) domestica)* of Europe is also found in some parts of the United States, in Baltimore, according to Mr. Uhler, and in Illinois, according to Professor Thomas. These insects feed on both vegetable and animal substances, and are sometimes injurious to woolen clothes, especially if moist. They are generally nocturnal in habits, and retire into their burrows during the day-time; being very partial to water, milk, and other fluids, they are frequently found drowned in vessels containing liquids. In this country we have a number of very closely allied species of crickets which live in the open air; almost all of them are of a dark, blackish or brownish-black color. They reside in the ground, and are found under stones and clods, and feed on both vegetable and animal substances. The field-crickets of Europe form burrows in the ground in which they live, and are said to be very voracious, and even cannibal in their propensities, killing and devouring their own species whenever they can overcome them. The crickets in this country injure grass, melons, squashes, potatoes, and other roots and fruits. The eggs of field-crickets are deposited in the autumn in the earth, and hatch the following season, some of the old insects surviving throughout the winter under stones, dead fallen trunks of trees, &c.

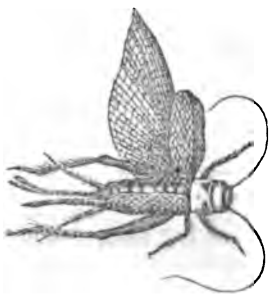

Fig. 15.

To destroy house-crickets, phials half filled with beer, milk, or any liquid will attract and drown them. A deep glazed earthenware jar, having a little food such as boiled potato or sliced cucumber in it, will serve as a trap for crickets, for when once in, they are unable to jump out again. Pills made of arsenic or Paris green and flour, or these poisons mixed with grated carrots or mashed potatoes, will poison them; but if such deadly poisons are ever used, great care should be taken that the dead insects do not fall into any of the domestic kitchen utensils, nor should they be swept where domestic fowls can find and eat them. If field-crickets are very numerous and annoying, many of the same remedies recommended for grasshoppers, such as plowing up the earth and exposing it to the winter's frost or rains, or rolling the ground very early in the morning will be of utility; but fowls, turkeys, and insectivorous birds are of inestimable value in destroying such insects as are found around gardens and houses, if they can only be kept out of the gardens themselves. Toads should never be killed in gardens, as they feed entirely on insects, and although they may not have

the "precious jewel" in their heads, yet they are themselves exceedingly precious to the horticulturist as having a lot of injurious insects in their stomachs, as any entomologist can affirm who has once taken the trouble to kill and dissect a toad in the morning after a good night's hunt in the grass or among the vegetables. The flower-crickets or climbing tree-crickets differ entirely from their relations, the field-crickets, in habits and form, as they live on trees and shrubs, or vines.

Œcanthus niveus, or, the white climbing tree-cricket, is very common in this neighborhood, and is remarkable for the difference of appearance between the two sexes, the male being of an ivory-white color, with flattened wing-covers, while the female is longer, the wing-covers much narrower, and the body of a greenish yellow or dusky color. Both sexes have long, slender hind legs, for leaping, and long, slender thread-like antennæ. The females injure the branches of apple, blackberry, cherry, currant, grape, peach, plum, pear, raspberry, &c., by making punctures in them in which to deposit their eggs. These eggs are placed in a row, contiguous to each other, the eggs being laid slantingly across the pith; at first the injury is shown only by a slight roughness of the bark, but afterward the twig or branch frequently dies above the puncture, or is so much injured as to be broken off by the first high wind. These eggs hatch about May, and the young insects hide among the foliage. The old insects are accused of girdling bunches of grapes, and thus causing the fruit to wither and fall; and although several entomologists state that they feed upon plant-lice and other injurious insects, yet any good they may effect in so doing is more than counterbalanced by the injury they do by causing the death of the twigs and young branches of fruit-trees. The males of these tree-crickets make a shrilling noise all night during the late summer and early autumn. The only remedy we can suggest would be to examine the trees and grape-vines in the autumn, and whenever or wherever a branch or twig appears to be injured cut it off immediately, and burn it, together with all the unhatched eggs it contains.

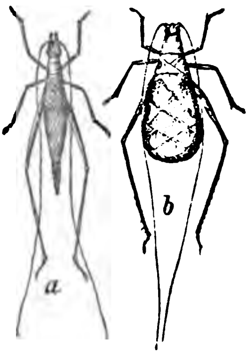

Fig. 16.

Sub-family 2 of the family of crickets (*Gryllidæ*) contains the mole-crickets, (*Gryllotalpinæ*,) so called from their great resemblance to the mole, the fore legs being palmate, short, stout, much flattened, and armed with solid tooth-like projections, like the fingers of a hand, and remarkably well adapted for digging in the earth. They generally live in moist places near water, and form passages or galleries in the soil. The European species are said to lay from two hundred to four hundred eggs, in a nest or kind of chamber under the earth. These insects make a dull, jarring, uninterrupted noise. They feed on vegetable and animal substances, and will eat raw meat; when pressed for food they will even kill and devour each other.

A correspondent of this Department sent some specimens of the short-winged mole-crickets (*Gryllotalpa borealis*) from Virginia, where he said the insects were very numerous, and had destroyed nearly his whole crop of potatoes, which were planted in moist ground. These insects also injure grass and vegetables, and sometimes injure green sod by burrowing

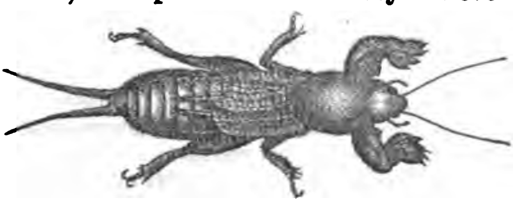
Fig. 17.

into it and cutting off the roots. When burrowing in the ground they form little ridges of loose, fresh earth wherever they make their underground passages, which usually terminate under a clod or stone. They are usually nocturnal in habits, and are active only during the night or in dark, cloudy weather. There are not many species of them in the United States, and all of them bear a strong resemblance to each other. In the West Indies, one species, *G. didactyla*, (the two-fingered mole-cricket,) does much damage to young sugar-canes, by destroying the shoots and boring into the cane. Mole-crickets are not very common in this country, and we hear very little of the injury done by them to our crops. Yet, in some parts of Europe they are plentiful, and said to do much injury in fields and gardens. They can be destroyed by digging pits, in September, two or three feet deep and one foot wide; these pits are filled with cow-manure and covered with earth. On the first appearance of frost the mole-crickets will resort to these traps, where they can readily be caught and killed. Moles and crows eat them, and Curtis says that oil and soap-suds will kill them, and that greasy manures, lime, and soot will assist in banishing them, should they increase so as to become troublesome in this country. They can also readily be poisoned by placing grated carrots or mashed boiled potatoes near their burrows, mixed with arsenic, or Paris-green, or a small piece of meat sprinkled with the same poisons, although great care should be used, when employing deadly poisons, to keep them out of the way of children and domestic animals or birds. Horse-dung is said to attract these insects, while pig-manure will drive them away. Water, suffused with a few drops of oil, poured into their holes, is also said to destroy them.

The following insects do not properly belong to the *Orthoptera*, but have been provisionally placed with them as bearing a close affinity in many respects.

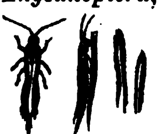
Fig. 18.

The *Thripidæ* were placed by Westwood in a separate order called *Thysanoptera*, or fringed-winged insects, from their wings being ciliated or fringed. Packard places them in the *Hemiptera*. These insects possess two setiform, horny mandibles, which, by their juncture at the tip, form a two-valved siphon. They are of very small size, with bodies long, linear, and depressed; the four narrow wings are fringed with hair, and, when at rest, are laid horizontally along the back. By some naturalists they are said to injure wheat, &c. Dr. Packard says they are very injurious to grain and flowers, "eating holes in the leaves or corollas, and sucking the sap from the flowers of wheat, in the bottom of which they hide." With a lens we have seen the sap oozing out of small punctures made by these insects on grape-leaves. Harris says "they live on leaves and flowers, in buds, or in crevices of the bark of plants. Their punctures poison plants and often produce deformities in the leaves and blossoms." Curtis in his work on farm-insects states that "the European species, *Thrips (Limothrips) cerealis*, once destroyed one-third of the wheat-crop in Piedmont, and that the shriveled grains of wheat are caused by the thrips extracting the milky secretion." Westwood says that "the thrips infests wheat to a mischievous extent, causing the grain to shrink." These are only a few extracts from reliable authorities, to show that by some it is considered an injurious insect, and yet on the other hand Mr. Walsh once said he "did not believe the true thrips to be a vegetable-feeder, but that on the contrary they are cannibal insects preying upon injurious larvæ;" and again he says "these insects have hitherto been considered to be vegetable-feeders, but they are generally, if not univer-

sally, insectivorous, and feed upon the eggs of the wheat-midge (*Diplosis tritici*) and on gall-making larvæ. A small yellow thrips is mentioned in Mr. Riley's second report as destroying the eggs of the curculio or plum-weevil." From the above statements it appears that in certain cases the true thrips, (not the insect generally known by the name of the grape-thrips, and which is a leaf-hopper,) is in some degree beneficial, by destroying other insects; but it appears to be very questionable if advantage from the few insects destroyed by them is at all commensurate with the injuries they inflict on our grain-crops, grape-vines, fruit-trees, and vegetation in general. The remedies suggested for the destruction of these insects, in gardens and green-houses, are the same as those suggested for plant-lice, (*Aphides*,) such as dusting with slaked lime, syringing with whale oil, soap and water; or strong soap-suds, tobacco-water, or a decoction of aloes or quassia and water and soap-suds, taking care not to wet the fruit, when on grape-leaves. It must, however, here be again remarked that the insect, generally known as the grape-vine thrips, is a homopterous insect or leaf-hopper, which, when disturbed, leaps with great activity from the leaves, and is not of the same long linear form as the true thrips, which generally remains stationary upon the leaf, or, at most, crawls slowly over it, and never flies in such swarms as the *Erythroneura*, or grape-vine leaf-hopper, whenever the vines are disturbed.

We next come to the bristle, or spring-tails, (*Poduridæ*, &c.) These insects also are not genuine *Orthoptera*. They were placed by Latraille in the order *Thysanaura*; Burmeister, however, considered them *Orthoptera* by the close resemblance of the mouth parts of *Lepisma*, especially the labium, to those of the *Blattidæ*, (cockroaches.) These insects are very small and have cylindrical (not flattened) bodies, their mandibles are small, and their bodies are covered either with bristles or small scales which are sometimes used as test objects for microscopes. They are furnished at the end of the abdomen with a forked tail or appendage, which, when at rest, is turned back and placed with its point to the breast. When the insect leaps, by a quick extension from behind of this appendage or tail, it is thrown in a forward direction, and is enabled to spring to a moderate height. The *Poduridæ* are found in hot-beds, under plants, leaves, stones, bark of trees, or wet chips, and some species are found in winter upon the snow; they are also found leaping upon the surface of stagnant pools of water. They feed ordinarily upon vegetable matter, dead leaves, small fungi, and one species is mentioned by Curtis as feeding on the pulp of potato-leaves, and is supposed to poison the sap. Wood-ashes or quicklime applied to the places they frequent will either destroy them, or drive them away, and watering with soap-suds has also been used with good effect.

Fig. 19.

Smynthurus has the body short and nearly globular. These insects are also very small, and are found on the leaves of plants, and are said to feed upon the pulp. Mr. Walsh did not appear to think they were injurious to vegetation, but Dr. Fitch says that when a flea-beetle (*Phyllotreta striolata*) has perforated a hole in a leaf, these so-called "garden-fleas" gather around the perforation to feed on the soft matter formed by the evaporation of the exuding juice, and Mr. Curtis states that a species of this insect, in Nova Scotia, destroys young turnips and cabbages. The same remedies as are applied to the *Podura* will also prove useful in driving these insects from the plants. In old, damp houses, small insects shaped very much like a fish, of a bright silvery appearance, with three long bristles at the end of the abdomen, may frequently

be seen running up the walls, whenever clothes or pictures, &c., hanging against them, are moved. These are vulgarly called bristle-tails, from the bristles at the end of their abdomens, or silver-fish, from their long, tapering, fish-like form, and the shining, silvery scales with which they are covered. These insects belong to the *Lepismatidæ;* they are very swift, running with great agility. In habits they are nocturnal, hiding in crevices of the floor and behind wall-paper, shelves, &c., by day. They possess rather large, hairy, stout mandibles, concealed at their tips under the upper lip. Their habits are the same as certain cockroaches, and they cut holes in woolen clothing. One species of *Lepisma* is a small insect of a leaden-silvery color, and is said to eat holes in cloth, tapestry, silken trimmings, and paste, and is sometimes injurious to books in libraries, by eating holes in the leaves and covers. Should they be found to be so numerous as to be troublesome in wardrobes and libraries, the same remedies can be applied as for cockroaches, (*Blattidæ.*)

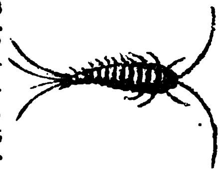

Fig. 20.

The *Mallophaga*, or biting bird-lice, also do not properly belong to the true Orthoptera, and were considered by Burmeister as forming a passage from Hemiptera to the Orthoptera, as they possess free biting-mouth parts, and especially free mandibles. Dr. Packard, however, places them with the Hemiptera. They differ from the true lice by having distinct jaws instead of a sucking-tube, and live on feathers, hair, skin-scales, &c., of birds and animals, and, as most authors state, never on blood like the true suctorial lice. De Geer, however, states that he found blood in them. The bodies of these insects are horny and firm above, and of a flattened form. The legs are short and stout, while the mandibles are small and harp-like. The number of species is very great, as almost every bird or animal has its special biting-louse, sometimes miscalled ticks.

For lice on fowls, three parts of common olive oil, with one part of kerosene oil, is recommended. If in the nests, kerosene oil applied to the wood-work will drive them away. Wood-ashes and road-dust for the fowls to scratch in and dust themselves with should be placed in the vicinity of the hen-coops, which, with the hen-houses themselves, should frequently be well white washed with lime, or washed with tobacco-water. In extreme cases, a wash of corrosive sublimate has been used, but it is extremely dangerous as being poisonous. A small piece of quicklime slacked, and then mixed with flowers of sulphur into a paste with wine or vinegar, and then diluted with water until it is of the consistence of weak whitewash, washed over the walls, will destroy the insects, but should be employed every week for three or four weeks, in order to destroy the young from the unhatched eggs. Professor Verrill recommends a solution of sulphuret of potassium in water, two to four ounces in a gallon of cold water, for lice on animals, as well as flies, mites, itch-insects, mange, acari, and all other external parasites of man and animals, and says there is no danger in its use.

TOWNEND GLOVER,
Entomologist.

HON. FREDERICK WATTS,
Commissioner.

REPORT OF THE CHEMIST.

SIR: I have the honor to present this report of the work in the division under my charge, and would state that the work thus reported has been performed since July 1, 1874, the work done previous to that time having been included in my former report.

Before stating the results of the work carried on in the laboratory of this Department, I consider it important to present, as concisely as possible, a summary of valuable facts relating to agricultural chemistry which have been discovered elsewhere during the past year.

1. The experiments of Professor Goessman, of the Massachusetts Agricultural College, upon the culture of the beet, have shown that it is better that the organic matter in the soil should be decreased, while the assimilable inorganic matters should be increased. Therefore a crop of beets should not be planted on a soil to which barn-yard manure has been recently applied. It is better to delay the sowing until the organic matter has been decomposed, and only the mineral matter remains, thus reducing the size of the beet, but greatly increasing its percentage of sugar. Deherain's experiments at Grignon furnished results of a very similar character.

2. Rissmüller, investigating the translocation of matter in plants, made analyses of beech-leaves at different stages of development, and found that the proteine bodies and hydrocarbons, as well as phosphoric acid and potassa, steadily increased until July, and then steadily decreased until the close of the season. He is of the opinion that a relation exists between the proportion of potash present and the production of hydrocarbons, as well as between the amount of phosphoric acid and the proteine bodies, and that this relation not only exists during the entire growth of the leaves, but that these inorganic principles accompany the organic constituents in their passage to the other organs of the plants, to increase them, or serve as nourishment in succeeding seasons. He does not consider that lime and silica in any way affect the production of silica, but only act as incrusting materials, or possibly, in case of lime, to combine with the organic acids, such as oxalic, which undergo no metamorphosis at the close of the period of growth.

3. In experiments upon the exhalation of moisture by plants in air and in carbonic acid, Mons. A. Barthelemy obtained results which led him to the conclusion that this action may be effected in three ways: 1st. By insensible exhalation from the entire surface of the cuticle by a true gaseous dialysis. 2d. By sudden emission of saturated gases which escape from the stomata when the plant is submitted to a rapid elevation of temperature, especially when inclosed. 3d. By accidental exudation resulting from a defect in the equilibrium between the absorptive action of the roots and the work of the parts exposed to the atmosphere in fixing carbon combined with the elements of water—work which ceases with the disappearance of light. He believes that it is also right to conclude that heat exercises a strong influence upon this function, and that, at equal temperatures, carbonic acid, in the presence of light, has the effect of diminishing the evaporation.

4. With regard to the exhalation of ozone by plants, Bellucci has found that the air is not ozonized by coming in contact with the living plants or with parts of plants recently cut, but that the reaction previously supposed to be due to the action of ozone produced in this way, is due to the action of free oxygen and light. The same test made with exclusion of light, other conditions remaining the same, gives no reac-

tion. These facts support the opinions resulting from the previous experiments of Cloëz and Scoutetten, and are themselves supported by the experiments of Mr. Charles Kinzett, of England, who showed that ozone is not produced during the oxidation of essential oils, but that the reaction heretofore supposed to be due to ozone is, in such cases, due entirely to the influence of certain easily reducible organic compounds of oxygen. The results of both the above investigators have been confirmed in a similar manner in our laboratory.

5. Haberlandt, by a series of important experiments, has shown that the limits of the temperature of germination of agricultural seeds vary from 3.8° R. to 35° to 40° R., but that the most favorable temperature for germination seems to be from 13° to 20° R. Though these may be the limits under ordinary circumstances, Krausen has shown that if wheat-grain be thoroughly dried by gradual heating, and with the aid of chloride of calcium, it may then be heated to the temperature of boiling water without losing its germinating power.

6. The presence of nitrate of potash as a definite compound in plants, has been fully demonstrated by at least two investigators during the past year. M. A. Boutin found in *Amarantus ruber* in the dried condition 16 per cent., and in *A. purpureus* 22.77 per cent.; and he recommends the cultivation of these, as well as *A. blitum*, which he has previously shown to contain this compound, for the production of niter. P. Gennadius has confirmed these statements, having obtained crystals of potassic nitrate from *A. albus* as well as from *Cannabis sativa*, *Lactuca sativa*, *Batata edulis*, *Lycopersicum esculentum*, *Lappa major*, and *Artemesia absinthum*. He has also demonstrated the presence of nitrous acid in a large number of other plants.

7. We have also to note the contributions made to our knowledge of the assimilation of nitrogen and ammonia by plants, and the formation of assimilable compounds of nitrogen from the nitrogen of the atmosphere. Reasoning from the results of Deherain's experiments, we would conclude that the atmospheric nitrogen used by the plant is supplied through the medium of the soil, where it is fixed by means of the hydrocarbons (such as humus) with the assistance of alkalies. This action is said to be favored by the absence of oxygen. Deherain's work has been more elaborately carried out by Armsby, under the direction of Prof. S. W. Johnson. The results of his experiments showed that the loss of nitrogen in the decomposition of nitrogenous organic matters in the compost heap could be very materially increased by the addition of caustic or carbonated alkalies. Ville states that in such decomposition 30 per cent. of the nitrogen present in the material is lost. Armsby finds that compost containing 3¼ per cent. nitrogen, most of it in organic combination, lost 11 per cent. of the nitrogen in two months. Addition of gypsum reduced this loss to 6 per cent., but when potash was added to the extent of 5 per cent. there was no loss, but an actual gain of 15 per cent. on the amount originally present. Professor Johnson's experiments in this particular, with caustic lime, will doubtless give similar results.

8. Contributions of an important character have also been made to our knowledge concerning the absorption of ammonia by the aerial portions of plants. That plants can absorb ammonia is fully established by the investigations of Schloesing and Mayer; but the latter investigator considers that we can have normal growth only when the ammonia is supplied to the roots, and that leguminous plants have no special power to absorb and assimilate atmospheric nitrogen.

9. With regard to the application of nitrogenous chemical compounds of an artificial character, Dr. Hellriegel, of Dahme, prosecuted an elab-

orate series of experiments, from the results of which it appears that ammonia-salts should not be applied to soils deficient in lime, for as the ammonia is taken up by the plants mineral acids are liberated, which have an injurious action on the roots.

SOUTHERN FODDER-PLANTS.

Cow-pea.—The species to which this plant belongs is exceedingly doubtful. It is largely used throughout the South for fodder and for green manuring. Its value for these purposes has not been determined by chemical analysis. To estimate its value for feeding purposes, seed was obtained and sown in the Department grounds, that we might select samples for analysis at various stages of growth. But the seeds were sown so late that we could make but one collection (some time before blooming) before the crop was destroyed by frost. We purpose making further investigation during the coming season; but a statement of the results already obtained may be of interest and value, and are therefore presented here.

The plants, on being collected, were carefully dried and submitted to preliminary examination, which showed the following general composition:

	Leaves.	Stems.	Roots.
Water	86.850	88.350	79.000
Organic matter	11.899	10.570	19.443
Inorganic matter	1.251	1.080	1.557
	100.000	100.000	100.000
Nitrogen in organic matter	.387	.168	....

Proximate organic analysis of the leaves and stems gave the following results:

	Stems.	Leaves.
Chlorophyll	2.10	6.90
Oil	2.00	2.30
Gum	20.47	14.05
Gluten	1.50	0.70
Sugar, dextrine, &c	1.90	15.60
Starch	10.33	7.70
Albuminoids	10.00	8.10
Cellulose	39.30	33.85
Inorganic matter	12.40	10.80
	100.00	100.00

On comparing these analyses with those of red clover and pease before blossoming, as given by Johnson, and calculated for dry material, we find that the "cow-pea" is nearly as valuable as either of these crops, as the following table will show:

Average of the entire plant.

	Green pease before bloom.	Red clover before bloom.	Cow-pea before bloom.*
Fat	3.2	3.94	2.15
Albuminoids	16.8	18.65	14.65
Starch, sugar, &c	43.2	43.5	38.025
Cellulose	28.9	25.45	36.575
Ash	7.9	8.46	8.60
	100.0	100.00	100.00

* The cow-pea had not reached the same stage of development as the green pease and red clover seem to have attained, and, as the proportion of nutritive constituents continues to increase until the time of blossoming, there can be little doubt that these proportions will, in time, be as great in the former as in the latter.

The following table shows the composition of the inorganic matter contained in the different parts of the plant:

	Leaf.	Stem.	Root.
Insoluble silica	9.83	1.175	23.03
Soluble silica	3.588	1.350	0.26
Lime	29.787	15.350	9.86
Magnesia	....	Trace.	....
Peroxide of iron	0.590	0.475	1.05
Phosphoric acid	4.317	5.375	7.00
Sulphuric acid	1.076	10.40	18.14
Potash	35.702	46.845	34.53
Soda	15.095	16.350	5.03
Chlorine	Trace.	1.86	0.64
	99.985	98.180	99.54

This is but a preliminary examination of this plant, which will be continued during the coming year. We have been unable to ascertain the product per acre, but our readers who cultivate cow-pease can make the necessary calculations as to its value for fodder and green manure.

We have also been requested by Mr. Chas. Mohr, of Mobile, Ala., to make an investigation of *Richardsonia scabra*, and its value as fodder. In his letter he describes it thus:

> It might not be devoid of interest for you to receive a sample of hay from *Richardsonia scabra*, which forms a large and important part of the spontaneous forage-crops of the pine woods on this part of the gulf coast. Hundreds of tons have been stored up this season in this county. It is much relished by the horses and mules, which seem to thrive well upon it, and it is consequently looked upon as equal in value to any other hay; and not less valuable is the green plant for soiling or pasture for cattle and sheep, which feed upon it with great avidity. The plant is known here by the name of "Mexican clover," "poortoes," or "pigeon-weed." Seventeen years ago it was but sparse; now it covers all our grounds brought under culture, covering the same with a luxuriant vegetation after the crops of the summer have been removed. It would be a matter of great interest to see the experience of our farmers verified by a quantitative determination of its albuminoid contents. It is of no less importance to ascertain by analysis of its ashes the quantity and quality of inorganic compounds removed, by its harvest, from our soils, naturally poor in alkalies and phosphates. Judging from its vigorous growth on the poorest lands, I deem it an ameliorating crop of great value to the lower pine-wood region.

The specimen received was thoroughly air-dried, and, when submitted to proximate organic analysis, it was found to have the following composition:

Oil		1.50
Gum	carbo-hydrates	13.80
Sugar, dextrine, &c.	carbo-hydrates	12.80
Starch	carbo-hydrates	11.00
Chlorophyll	nitrogeneous compounds	5.20
Gluten	nitrogeneous compounds	0.90
Albuminoids	nitrogeneous compounds	9.60
Cellulose		33.30
Inorganic matter		11.90
		100.00

We give the following table of the composition of red clover in full bloom, calculated for dry substance, as in the above case, in order that the two may be compared:

Fat	3.4
Albuminoids	16.1
Starch, sugar, &c	37.6
Cellulose	35.1
Ash	7.8
	100.0

This is an average of analyses made by Wolff and Knop.

The analysis of the ash of the Richardsonia resulted as follows:

Insoluble silica	22.740
Soluble silica	2.740
Lime	29.456
Magnesia	1.605
Phosphoric acid	7.457
Peroxide of iron	Trace
Sulphuric acid	2.617
Chlorine	2.840
Potassa	23.824
Soda	6.860
	99.639

With regard to its value as a feeding material, it will be seen that it is about equal to that of clover-hay. For green manuring it can scarcely be compared with clover, since the composition of the inorganic matter is so variable. Thus we find* that the inorganic matter of clover-hay contains—

Silica	5.7
Lime	32.4
Magnesia	9.2
Phosphoric acid	13.4
Peroxide of iron	1.4
Sulphuric acid	8.7
Chlorine	1.4
Potassa	18.7
Soda	7.4
	99.3

In this case we have more of phosphoric acid and less of potash than in case of the Richardsonia. The latter will, therefore, be of value as an ameliorating crop to precede some crops, while clover may be more advantageous for others, and thus they may be employed interchangeably. As in the case of the cow-pea, we cannot estimate the total amount of inorganic matter per acre.

Judge W. Schley, of Savannah, Ga., sent to the Department a sample of material, with a statement to the effect that it had been discovered in considerable quantity in a cave near that city, and requested that it be examined to determine its value as a fertilizer. He gave no description of its location or surroundings. The sample was nearly white, pulverulent, becoming lumpy on compression, and appeared the result of deposition. Preliminary tests indicated that it was of considerable agricultural value, and we therefore made a complete analysis, which showed the following result:

Insoluble silica	6.200
Soluble silica	0.600
Lime	14.320
Magnesia	3.430
Alumina	13.530
Peroxide of iron	7.340
Soluble phosphoric acid	8.400
Insoluble phosphoric acid	6.100
Potassa	2.530
Soda	0.357
Sulphuric acid	3.870
Chlorine	Trace.
Nitric acid	Trace.
Carbonic acid	Trace.
Moisture	16.100
Organic matters containing 0.119 per cent. nitrogen, equivalent to 0.1445 per cent. ammonia	16.250
	99.027

* Wolff's Aschen-Analysen, p. 67.

The high percentage of soluble phosphoric acid in this material is somewhat surprising; yet this, with the fair percentage of nitrogen and potassa it contains, and its very favorable mechanical condition, render it available for immediate application to the soil for almost any kind of crops. It is seldom that we find such a combination of fertilizing materials in the natural condition, and the planters of that section may consider themselves fortunate in having at hand such valuable available plant-food of a stimulating character, should further inquiry show its existence in large quantity.

The seeds of the castor-plant (*Ricinus communis*) have not been very extensively produced in this country until within a few years, and, to determine how American seed will compare with that grown in Europe, Mr. J. P. Lawrence, of Dallas, Tex., sent to this Department a sample of seed—portion of a large crop of his own cultivation. It seems to belong to the variety *Ricinus sanguinarius*, and, to make the desired comparison, we made analyses of this sample and of other samples grown in France.

The analyses resulted as follows:

	I.	II.	III.
Moisture	4.40	4.35	4.10
Oil	46.95	47.78	45.55
Matter extracted by alcohol and water	6.35	4.20	4.40
Starch	8.875	9.81	12.50
Albuminoids	3.788	3.10	2.40
Cellulose	25.50	27.22	27.70
Inorganic matter	2.90	2.90	2.94
	98.763	99.36	99.59

No. I represents the composition of the sample of *Ricinus sanguinarius* grown in Texas; No. II, the same variety grown in France; while No. III represents that of a sample of *Ricinus minor* grown in France.

It thus appears that, so far as the oil-contents of the seeds are concerned, the American sample is about as valuable as the European. The following are the results of an analysis of the mineral matters contained in the beans of the *Ricinus sanguinarius*:

Lime	11.31
Magnesia	7.33
Peroxide of iron	0.89
Phosphoric acid	38.657
Sulphuric acid	2.218
Chlorine	0.89
Potassa	29.52
Soda	8.75
	99.565

PARIS GREEN—ITS USE IN AGRICULTURE.—The question of the use of arsenical compounds in agriculture for the destruction of noxious insects has elicited considerable discussion, and we have received from our correspondents in different sections, especially those infested with the Colorado potato-beetle, very many and various questions, which have led us to the consideration of several points concerning it.

Some of the farmers seem to consider that, when applied to the potato-crop for the destruction of the beetle, it will have an injurious and poisonous influence upon the tubers. Others fear the absorption of arsenic by the tubers to a sufficient extent to be injurious to the health of the consumer. We have also received applications for information concerning the

use of arsenical compounds in solution and their probable effect upon vegetation. And the question as to whether or not arsenic could be absorbed and assimilated has also raised in our own minds the question whether the arseniates of the alkaline earths can substitute the corresponding phosphates, all being included in the same chemical classification, in the economy of plant-growth. The results of our experiments in this particular, though not complete, may, to a certain extent, settle the first point. The full description of these experiments must be given hereafter, but a partial statement of the results seems pertinent here. A number of boxes of soil were prepared with pure washed sand containing a mixture of kainit, (crude sulphate of potash,) gypsum, (sulphate of lime,) and each of the boxes containing respectively the arseniates of lime, baryta, strontia, and magnesia. Alongside of these boxes were others prepared in a similar manner, but containing the phosphates instead of the arseniates of the alkaline earths. In all of the boxes pease were sown, and after ten days a large number of the seeds planted in the boxes containing the arseniates had failed to germinate, and those plants which had sprung up were very weak and sickly. Fresh seeds were sown in those portions of the boxes in which the seeds had previously failed to grow, and this time a tolerably fair proportion of the seeds germinated. But, as in the previous instance, they failed to evince a healthy condition of growth. The seeds were sown early in August, and on account of the frost it was found necessary to collect the plants in the latter part of October, when they were just about blooming. On testing specimens at different stages of growth by means of Marsh's test, after having boiled the green plant with solution of chlorate of potash and hydrochloric acid, not a trace of arsenic could be detected. When the plants were taken up it was found that the tap-root was destroyed, and that sufficient small fibrous lateral roots had been thrown out to form a thickly-matted mass. The end of the tap-root, or what remained of it, was covered with a thick, fleshy knob, not very large, but apparently an extension of the bark of the root. We are not fully satisfied as to whether this condition is due to a deficiency of nutriment in the soil, or to a distinctly poisonous action of the arsenical compounds. It would seem, however, that the latter was the case, since the tap-root of the boxes similarly prepared, but containing no arseniates, were perfectly sound. We shall, nevertheless, vary our experiments with a determination of this point in view.

Mulder states* that plants may be poisoned by many principles which are poisonous to the animal organism, but holds that they do not attack directly what is called the vital principle, but affect the proximate organic principles of the plants, changing the conditions under which they exist, and thus prevent the transmission of liquids from the roots. In support of this idea he cites the coagulation of the albumen of the plants by the metallic oxides, such as lead, copper, &c. In case of arseniates of the alkalies and alkaline earths this would scarcely occur, since the acids of arsenic have no such effect upon albumen, and indeed there is, so far as we know, no fact recorded in which they have been known to form any combination with the other constituents of the plant. In the use of metallic compounds of arsenic, however, this action may possibly take place.

We have also conducted some investigations upon the assimilation of arsenic by plants in case of direct application of Paris green itself, but the results of our experiments seem in this instance also to be of a nega-

*Chemistry of Animal and Vegetable Physiology, English translation, 1849, page 626.

tive character. The investigation has not been as full as we desire, but we shall give the results for what they are worth. Upon a lot of "cow-pea," a leguminous plant used as a foddering-material in the South, growing in the Department grounds, was freely dusted Paris green as obtained from the shops without any admixture of foreign substances. The material did not, however, seem perfectly unadulterated. In the first case the amount applied seems to have been too large, as all the plants were killed. Subsequently, however, a mixture of Paris green and gypsum, in the proportions usually recommended, was applied, and the small terminal buds and leaves were killed. But in a short time lateral buds appeared, healthy branches developed, and the plants grew thriftily without seeming to be otherwise affected. Examinations of the plant at different stages of growth, by means of Marsh's test, carefully applied, failed in any case to reveal the presence of arsenic. It is, however, possible that, had the plants had an opportunity to mature, arsenic might have been assimilated. In this connection the results of the experiments of Prof. E. W. Davy* are exceedingly interesting. Being aware of the fact that nearly all of the sulphuric acid employed in the manufacture of superphosphates in Dublin was made from pyrites, which almost invariably contained arsenic, he considered it of some importance to determine whether the arsenic which thus passed into the superphosphates, and must, therefore, be communicated to the soil in the most favorable condition for assimilation by plants, could enter into the vegetable organism. As a preliminary experiment to determine whether arsenic could be taken up by the plant, he watered pease, which had been transplanted into a pot containing rich garden-soil, with a concentrated aqueous solution of arsenious acid. This treatment was repeated every second or third day for more than a week, and then discontinued. At the end of some months, the plants having grown to full size, flowered, and fruited, it was found by application of both Marsh's and Reinsch's tests that the arsenic had permeated every part of the plants. Being thus satisfied that plants were capable of taking up arsenic during their development, he made some experiments with the use of phosphates containing arsenic. The sulphuric acid employed in their manufacture contained about 2.8 pounds arsenic per ton, and the proportions employed were one ton of acid per two tons of bone. The amount of arsenic in the superphosphate was therefore relatively very small.

In his next experiment he prepared a soil consisting of one part superphosphate and four parts garden-mold, into which he transplanted a small cabbage-plant. At the end of three weeks an examination for arsenic, with a small portion of the plant, (113 grains,) gave the "most distinct indications of the presence of that substance." Since, however, he considered the conditions in this case very favorable to the absorption of arsenic, he examined carefully different samples of Swedish turnips which had grown in a soil to which superphosphate had been applied at the rate of six hundred-weight per Irish acre, and found arsenic in each case. It is also stated that sheep refused to feed freely upon the turnips grown upon soil to which the superphosphate had been applied.

The results of Professor Davy's experiments do not, however, seem to have been confirmed by the results of later investigations, and, in fact, so far as we have been able to learn, these have been of a decidedly contradictory character. Thus Mr. E. H. Ogston,† doubting that a satu-

* Phil. Mag., vol. xviii, p. 108.

† Gardner's Chronicle, 1860, 216.

rated solution of arsenious acid could be applied to plants without injury to them, and that the amount of arsenic communicated to the soil by the application of superphosphates would be large enough to appear in the plant in sufficient quantity to be detected by the ordinary tests of the laboratory, repeated the experiments by watering some strong cabbage-plants of some weeks' growth with a saturated solution of arsenious acid, and though only two doses were administered in three days, the plants drooped and died in less than a week. Repetition of this experiment with Scotch kale afforded similar results. After a few days all the plants experimented upon were removed from the ground, and various portions of the stems and leaves examined for arsenic by means of the Marsh test, when the poison was found "only in the portions of the stems close to the roots, which were darkened in color in the interior. In no case was the poison found in the stem at more than five inches from the ground." Mr. Ogston experimented with other solutions of arsenious acid, but found that, when the dilution was sufficiently great to prevent injury to the plant, no arsenic could be detected in any portion above ground.

With regard to the absorption of arsenic in case of the Swedish turnips, without any experiments, he reasons that the quantity applied per acre in the superphosphate is not sufficient to render it possible to detect its presence in the root. But admitting that the plant will absorb arsenic with the same avidity as phosphoric acid, which, reasoning from the evidences on record, is scarcely possible, close calculation shows that when the quantity which might be introduced to the soil through the medium of the superphosphate is present, enough could be taken up to be detected by the delicate tests at our command.

The conclusions arrived at by Mr. Ogston seem to be corroborated by the results of the investigations of Daubeny.* In his experiments he watered a plot of ground of 100 square feet, containing young barley, with a solution of arsenious acid, in the proportion of two ounces per ten gallons of water, and after six days the crop had a blighted appearance. A similar plot was then watered with a solution of half this strength, and after two applications, at an interval of twelve days, this crop also appeared to be injured. The treatment was, however, again continued after a short time, so that in all five applications were made, yet the crop matured.

A similar plot sown with turnips received applications amounting to 4 ounces arsenious acid per 100 square feet, and were in no wise injured. In case of the barley the indications of arsenic shown by the Marsh test were very slight, and in case of tests made both by the author and by Professor Brodie, decidedly negative results were given.

It will therefore be seen that the general character of the results which have been obtained from investigations upon this subject has in the main been negative.

In this report I have presented the results of my preliminary experiments, with the history of the matter, without waiting for the completion of my investigations, because I consider it of some importance to place these facts before the public as early as possible. These investigations, and others yet under way, shall be continued as fast as possible, and the results will be presented in a subsequent report.

Very respectfully,

WM. McMURTRIE, *Chemist.*

HON. FREDERICK WATTS,
Commissioner of Agriculture.

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* Jour. Chem. Soc. XIV, 225.

REPORT OF THE BOTANIST.

SIR: During the past year the work of the botanical division has been steadily prosecuted. The plants collected by the expeditions of Lieutenant Wheeler and Professor Hayden have been transferred to this Department by the Smithsonian Institution, and have been appropriately cared for. There have been otherwise contributed to the botanical collection as follows:

1. A valuable set of the plants of Southern Utah, collected by Capt. F. Bishop, of Salt Lake City, among which plants are two or three new species.
2. A package of plants collected near Mobile, Ala., by Mr. William Harvey.
3. A large package of the plants of Southern Indiana, made by Mr. Coulter, of Hanover, Ind.
4. A small package of Colorado plants, from Mr. H. N. Patterson, Oquawka, Ill.
5. Through the Smithsonian Institution, six packages of the mosses of Central Europe, from Mr. Paul Reinsch, of Germany, containing species mounted for the microscope, and also illustrated by magnified figures.
6. Through the Smithsonian Institution, a package of Illinois plants, comprising about 800 species, from Dr. Fred. Brendel, Peoria, Ill.
7. Through the Smithsonian Institution, a collection of plants, made by Mr. J. A. Allen in Dakota and Montana, on the Yellowstone expedition, General Stanley commanding.
8. Through the Smithsonian Institution, six boxes, embracing about 100 specimens of models of German fungi. These models have been mounted on stands and placed in the museum, where they are objects of interest and value.
9. A very fine collection of the plants of Southern Utah, made by Mrs. E. P. Thompson, and by her presented to the Department. This collection embraces a number of the new species recently described by Mr. Sereno Watson, many of the others being rare and valuable.

From these various collections the botanist has made such selections as were desirable for the perfection of the herbarium, and they have chiefly been mounted and incorporated in their proper places, in order that the herbarium may as soon as possible contain a complete representation of the plants of the United States. A large portion of the duplicate plants have been carefully prepared in packages and distributed, first, to foreign societies and individuals who have made contributions to the herbarium; and, secondly, to home scientific societies and institutions of learning, as follows:

Two packages to Prof. Paul Reinsch, Zweibrücken, Germany, containing 305 species.

Two packages to Dr. Francis Lagger, Freiburg, Switzerland, containing 261 species.

One package to Dr. K. Keck, Schwertzberg, Upper Austria, containing 215 species.

One box to the St. Petersburg Imperial Academy of Science, containing 656 species.

Two packages to the University of Virginia, containing 300 species.

One package to the Philadelphia Academy of Sciences, Philadelphia, containing 188 species.

One package to the Agricultural College of Tennessee, containing 207 species.

One package to the Indiana Normal School, Terre Haute, Ind., containing 187 species.

One package to the Rockford Female Seminary, Rockford, Ill., containing 239 species.

One package to the Chicago Academy of Sciences, containing 244 species.

One package to the Illinois Industrial University, Urbana, Ill., containing 157 species.

One package to the Massachusetts Agricultural College, Amherst, Mass., containing 188 species.

One package to the Buffalo Academy of Sciences, Buffalo, N. Y., containing 278 species.

One package to the Baltimore Academy of Sciences, Baltimore, Md., containing 196 species.

One package to the Princeton College, Princeton, N. J., containing 116 species.

Also, packages to the following individuals, chiefly in exchange for plants sent the Department:

One package to Mr. W. M. Canby, Wilmington, Del.

One package to Mr. H. W. Young, Aquebogue, Long Island.

One package to Professor T. C. Porter, Easton, Pa.

One package to Professor H. H. Babcock, Chicago, Ill.

One package to Dr. Fred. Brendel, Peoria, Ill.

One package to Professor D. C. Eaton, Yale College, New Haven.

One package to M. S. Bebb, Winnebago Station, Ill.

One package to Mr. William Harvey, Mobile, Ala.

Included in the above distributions are several special sets of the grasses and carices of Lieutenant Wheeler's expedition of 1873. Sets of the same not included above were also sent to Professor Gray, Cambridge; to the Royal Herbarium, Kew, England; and to the Imperial Academy of St. Petersburg.

Very gratifying letters of acknowledgment have been received from many of the societies, institutions, and individuals above named, showing the high appreciation of this work of distribution. There still remains a large quantity of duplicate plants, of which fifteen or more large packages will be ready for distribution by the 1st of January next.

Many inquiries of a botanico-agricultural character, from farmers, planters, and others in all parts of the country, have received careful attention, and have been properly replied to. Many of these inquiries relate to grasses suitable for cultivation in the Southern and Southwestern States. Observations and experiments in this matter are now being carefully made by many individuals, which give promise to result in discoveries of great economic value to those portions of the country.

It is believed that much valuable information of a practical character is both received and communicated through the medium of this division of the Department of Agriculture.

GRASSES FOR THE SOUTH.

The peculiarities of climate and soil in the Southern States are such as do not seem favorable to the successful cultivation of the grasses which succeed everywhere in the Northern States. This fact has directed the attention of southern farmers and planters to the cultivation

of native species, or to the introduction of foreign kinds which should have an adaptation to their wants.

Specimens of different kinds have been sent to us for determination, accompanied by statements of their value, from which we give some extracts which seem deserving of attention:

JOHNSON GRASS.—Mr. John Haralson of Selma, Ala., writing of this grass, says:

I beg to call your attention to a grass that is grown in this section, and known here as the Johnson grass. It propagates from the seed and roots. It sends up a tall stem, very tender till after seeding-time, with long and luxuriant blades, resembling the blades of Chinese sugar-cane or chicken-corn. It puts out among the earliest vegetation in spring, and soon yields a crop for mowing. On good land it may be mowed half a dozen times in the year. It succeeds very well on any kind of soil, on ridge or bottom lands, and in the very fertile black or bottom lands yields a rank and unsurpassed crop in abundance. Stock of all kinds love it, and, where it grows, give the preference to it over any other growth. There is a divided sentiment in reference to it in this section, where people think of growing nothing else but cotton and corn; all are agreed, so far as I know, that for a stock-growing country it is the best grass known. Many persons here object to it because of its great tenacity of life, matting the soil with deep and spreading roots, like the cane-roots, and the rapidity with which it spreads itself over a farm when once set, and the difficulty of eradication, in case one desired to subdue it for some other crop. This class of persons admit its virtues as a forage crop such as I have mentioned. Others again contend that it may be confined to one field, if it is fenced and not allowed to go to seed, and that by constant pasturage and mowing, and turning the soil over in winter, to expose the roots to frost, it may be subdued. Experiments in this direction have not reached satisfactory results as yet. It is proper to add that the name given it here is from the man who brought it to this country many years ago, whose name was Johnson, and it is said to be what is known as the Guinea grass. An examination of the books in reference to that grass, however, does not convince me of its identity, or else that very little is known by the writers on grasses of the Guinea grass. The seeds are abundant, somewhat like the chicken-corn, but not so abundant on the stalk, and weigh about 35 pounds to the bushel.

This grass, upon investigation, proves to be *Sorghum halapense*. It is a perennial grass, with strong vigorous roots and abundance of long and tolerably broad leaves. Dr. Chapman, in his Botany of the Southern States, mentions this species of sorghum as being sometimes cultivated under the name of Cuba grass. It is perhaps also called Guinea grass, but improperly, as that name belongs to a species of *Panicum*, probably *P. jumetorum*, which has been cultivated in the South, with various and opposite opinions as to its value. The name is also applied to the millet, (*Panicum miliaceum*.)

PHALARIS INTERMEDIA, *Bosc.*—This is a native grass of rather wide range in the Southern and Southwestern States. It is quite stout and leafy, growing 2 to 3 feet high, with a spike of flowers at the top, 2 to 4 inches long and ½ to ¾ inch thick, somewhat like a head of timothy, but much thicker, and the flowers more loosely packed and much larger. It was noticed in the Monthly Report for July, 1873. More recently it has been sent to us by Mr. John Handy, of Canton, Miss., who says that all kinds of stock are fond of it, especially as cured hay. It has also been sent from other sources with similar statements. It should receive a careful investigation and trial.

BROMUS UNIOLOIDES, *Willd.*; BROMUS SCHRADERI, *Kunth.*—This grass some years ago received prominent attention in Europe, but is now little known in cultivation. It is a tall leafy-stemmed grass, with a spreading panicle of drooping spikelets which mature an abundance of large and nutritive seeds. Mr. J. H. Krancher, of Millheim, Tex., sends specimens to the Department with the following remarks:

Inclosed I send a sample of grass that has, for the last two years, been growing spontaneously in my field and neighborhood, about fence-corners, &c., with great luxuriance. It makes its appearance about the month of January, or earlier, grows to the length of 3 feet on good land, and is now (April 18) about maturing. Horses and other stock ar very fond of it. It appears to be valuable as an early green feed.

HOLCUS LANATUS—VELVET GRASS—SOFT GRASS.—This is a European grass, which has been to some extent introduced into this country, particularly as a part of the mixed grasses known as lawn-grass. Mr. Nathaniel A. Gregory, Oxford, N. C., sends specimens, with the following remarks:

I inclose you a sample of grass, with the request that you will give me its name. Some gentlemen here pronounce it the Texas mesquit, but none of us know for certain. My father owned the place upon which I now live, bought some thirty-five or forty years ago. It was on the place at that time, and I have recently learned that it is found in several other places in the county. It would seem from this that it is indigenous to our clay lands. I picked up the seed on my place, and have now some two acres sown, and have just cut (June 29) the prettiest lot of hay I ever saw. Orchard-grass in the same field will not compare with it.

PLANTS POISONOUS TO CATTLE IN CALIFORNIA.

Several notices have been given during the year past of plants called "loco" and "rattle-weed," natives of California, which there are said to poison and cause the death of many cattle. We obtained, through the kindness of Mr. Wellington Canfield, of Bakersfield, California, good specimens of the plants in question, which proved to be species of *Astragalus*, viz, *A. Hornii*, Gr., and *A. lentiginosus*, Gr.

Mr. Canfield has had practical experience with these plants, having lost by their poisonous effects a large number of horses and other stock. There seems also to be an agreement between persons living in different parts of California as to the plants to which these poisonous properties are ascribed. Mr. Canfield thinks that, although the two species of Astragalus above mentioned are the more common and frequent causes of the poisoning, there are several others of the same properties. The genus astragalus embraces a great number of species, inhabiting California, Nevada, Utah, and all the region of the plains. In California some of these attain great luxuriance, growing with much the habit and vigor of lucern.

The general symptoms and effects of the poisoning are given by Mr. O. B. Ormsby, as follows, (see Monthly Report, 1873, October, p. 503:)

It prevails quite abundantly over an extent of one hundred and fifty square miles in this valley, and, I am informed, is found in other valleys of the State, and also in Arizona. This year the army-worm, and a minute insect which destroys the seeds, have killed a great deal of it, but, if not molested, it will soon flourish to as great an extent as ever. I think very few, if any, animals eat the loco at first from choice; but, as it resists the drought until other feed is scarce, they are at first starved to it, and after eating it a short time appear to prefer it to anything else. Cows are poisoned by it as well as horses, but it takes more of it to affect them. It is also said to poison sheep. As I have seen its action on the horse, the first symptom of the poisoning, apparently, is hallucination. When led or ridden up to some little obstruction, such as a bar or rail lying in the road, he stops short, and, if urged, leaps as though it were four feet high. Next, he is seized with fits of mania, in which he is quite uncontrollable, and sometimes dangerous. He rears, sometimes even falling backward, runs or gives several successive leaps forward, and generally falls. His eyes are rolled upward until only the white can be seen, which is strongly injected, and, as he sees nothing, is as apt to leap against a wall or man as in any other direction. Anything which excites him appears to induce the fits, which, I think, are more apt to occur in crossing water than elsewhere, and the animal sometimes falls so exhausted as to drown in water not over two feet deep. He loses flesh from the first, and sometimes presents the appearance of a walking skeleton. In the next and last stage, he only goes from the "loco" to water and back, his gait is feeble and uncertain; his eyes are sunken, and have a flat, glassy look; and his coat is rough and lusterless. In general, the animal appears to perish from starvapian and constant excitement of the nervous system, but sometimes appears to suffer acute tion, causing him to expend his strength in running wildly from place to place, pawing and rolling, until he falls, and dies in a few minutes.

Mrs. J. S. Whipple, of San Luis Obispo County, sends us specimens of the same plants, and says, (see Monthly Report for July, 1874, p. 331:)

The description of the loco plant given in the Monthly Report was correct. It grows in abundance in several counties in Lower California, and appears to be a natural production of the localities where found. It occurs on high and low, wet and dry lands. Animals are not fond of it at first, or don't seem to be, but after they get accustomed to the taste they are crazy for it, and will eat little or nothing else when the loco can be had. There seems to be little or no nutrition in it, as the animal invariably loses flesh and spirit. Even after eating of it they may live for years if kept entirely out of its reach, but if not, they almost invariably eat of it until they die. I sent to Bakersfield for the loco, as it does not grow just here. The rattle-weed, of which I send a sample, seems to be a kindred plant and of the same nature, producing nearly the same effect. It grows in this locality in abundance. This also flourishes on the mountains and in the valleys on wet or dry land, but is confined to certain counties, or is not found in all parts of the State. If eaten freely of at first the animal sometimes dies in three days, but sometimes lives two or three weeks, and, as with the loco, if but little is eaten and the animals are kept from it, they may possibly get over its effects.

This subject has likewise been discussed in the California papers, and measures will undoubtedly be taken by those interested to exterminate these plants or otherwise prevent their stock from having access to them.

OXYTROPIS LAMBERTI, (said to be poisonous to cattle.) Recently some specimens of a plant sent from Colorado by Dr. P. Moffatt, assistant surgeon U. S. A., to the office of the Surgeon-General, were submitted to this Department for name, accompanied by the following extract from the report of Dr. Moffatt:

Cattle-men inform me that a weed grows among the grass, particularly in damp ground, which is poisonous to horned cattle and horses, and destroys many of them. From the manner in which they describe its effects upon the animals it must be of the nature of a narcotic, and they assure me that cattle, after having eaten it may linger many months, or for a year or two, but invaribly die at last from the effects of it. The animal does not lose in flesh apparently, but totters on its limbs and becomes crazy. While in this condition, a cow may lose her calf and never find it again, and will not recognize it if presented to her. The sight becomes affected so that the animal has no knowledge of distance, but will make an effort to step or jump over a stream or an obstacle while at a distance off, but will plunge into it or walk up against it upon arriving at it. The plant was pointed out to me, and seems to be related to the Lupin.

The plant submitted to us as the one in question was the *Oxytropis Lamberti*, a plant of the pea-family, nearly related to the Astragalus, and also to the Lupin. It grows in considerable abundance upon the elevated plains near the mountains, and extends up into the mountains to the elevation of 7,000 to 8,000 feet. It is perennial, and grows in small clumps, the leaves all at the base, and sending up a few erect flower-stalks, seldom over a foot, which have a spike-like raceme of rather showy flowers, varying in color from cream to purple. These are succeeded by short, stiff, pointed pods, which contain a number of small, clover-like seeds. If the statements above given respecting these two or three leguminous plants are substantiated by further experiment and observation, it will be interesting to determine by chemical analysis what is the peculiar poisonous principle which they contain. Plants belonging to this natural order (*Leguminosæ*) have generally been considered as not possessing poisonous properties.

GEORGE VASEY,
Botanist.

Hon. FREDERICK WATTS,
Commissioner.

Short cranberry-vine, (New Jersey.)

MICROSCOPIC OBSERVATIONS.

BY THOMAS TAYLOR.

CRANBERRY ROT AND SCALD.—During the present year the Department has received numerous letters from cranberry-growers, calling attention to a disease of the cranberry known as rot or scald, which has appeared, especially in the cranberry-plantations of New Jersey, during the last three years. The following letter, placed in the hands of the Commissioner of Agriculture by Hon. S. A. Dobbins, M. C., shows the importance and necessity of a thorough investigation of the disease, with a view to the discovery of its cause and the means of preventing its recurrence:

TRENTON, *March* 12, 1874.

DEAR SIR: You are aware that the cranberry-culture has become a very large business in most of the sea-board counties of this State. The failure of the crops for the last two or three years has been a serious loss to those counties, and threatens to affect injuriously their productive interests perhaps for many years to come. Various opinions have been entertained with regard to the blight of this important crop. Some have attributed it to animalcules, others to climatic causes, but as yet the true cause has not been determined. Much anxiety is felt by hundreds who have invested in the cultivation of this fruit, and the New Jersey Cranberry Association, composed of a large number of respectable citizens of the counties of Cape May, Atlantic, Ocean, and Monmouth, at their late session, desired me to write to you on the subject. We are informed that the Department of Agriculture at Washington is in the habit, when requested, of sending some scientific person to make a critical analysis and examination in such cases, with a view to ascertain the *real cause* of the rot, and devise, if possible, such treatment as will prevent it. You will greatly oblige many of your personal friends and fellow-citizens if you will make inquiry, and procure the services of a proper scientist to make the examination desired. It is said that the Department is very ready to make such investigations, and will, when occasion requires, send a competent person, free of charge, for the purpose.

I think it probable that in Ocean County, New Jersey, the loss on the cranberry-crop for the last year approximates $100,000; that is, the loss by what is familiarly called the "scald."

Yours, truly,

GEO. F. BROWN.

Hon. S. A. DOBBINS, *M. C.*

On the 10th of July last the president of the New Jersey Cranberry-Growers' Association wrote to the Department as follows:

BORDENTOWN, N. J., *July* 10, 1874.

DEAR SIR: At the last meeting of the New Jersey Cranberry-Growers' Association, Dr. George Goodale and myself were appointed a committee to procure, if possible, a scientist from the Department of Agriculture to investigate the cause of the cranberry-rot, which has been so fearfully destructive in some portions of our cranberry-region. If consistent with your views, we should be pleased to have a suitable person sent from your Department to meet us at Philadelphia, for the purpose of making arrangements to visit some of the principal plantations affected with this disease, and to suggest, if possible, a remedy.

Respectfully, yours,

JOHN H. BRAKELEY.

Hon. FREDERICK WATTS,
Commissioner of Agriculture.

These letters were referred to me by the Commissioner of Agriculture, with instructions to make the desired investigation. Previous to visiting the cranberry-plantations, I deemed it best to make an examination of the healthy and the unhealthy vines, their roots and fruit, with samples of the soils in which they grew, and now present a preliminary report of the results of my investigations. I accordingly requested Mr. A. J. Rider, of Atsion, Burlington County, to forward to this De-

partment such specimens as were necessary. Two specimens of vines, one healthy the other unhealthy, were received by the Department, and a specimen of the soil in which each plant grew. An examination of the roots of each vine showed that the one which bore rotting fruit had much larger and darker roots than the other. The peaty muck in which the healthy plants grew had a pleasant odor, and was not in a fermenting condition, while that of the unhealthy plant was in a condition of fermention, and had the odor of sulphureted hydrogen. A second set of plants was received, with specimens of the soil in which they grew. It was again observed that the vines on which unhealthy berries grew had darker and larger roots than those which bore healthy fruit, and that the soil of the latter was odorless, while that of the former had a bad odor, and was in a fermenting condition. These facts led me to believe that the sour condition of the soil was the primary cause of the rotting of the berries.

On the 22d of July last I visited Cranberry Park Station, Atsion, Burlington County, in company with the Rev. J. H. Brakeley, president of the New Jersey Cranberry-Growers' Association; Messrs. A. J. Rider, secretary and general superintendent of the Cranberry Park Company; George G. Miller, superintendent of Hammonton Cranberry Company; E. W. Crane, of Caldwell; C. G. Rockwood, of Newark; Japhet Alston, of Pemberton; and N. R. French, of New York. All are directly interested in cranberry-culture. We made a careful examination of the condition of the soil at that place, the mode of cultivation, the roots of the vines, their foliage and fruit, the construction of water-dams, ditches, &c.

The plantations of the company comprise about 130 acres of vines, the greater part of which were set out in the year 1869. In 1871 there was a light crop, partly rotted; in 1872 half a crop, and nearly all rotted; in 1873 a full crop, and nearly all rotted, only 300 bushels of sound fruit being picked out of a total crop estimated at 10,000 bushels. No fertilizers were used till the spring of 1873, when sand and plaster were applied to the higher portions of the land, a small area being at the same time treated with a coating of decomposed turf. No rain fell after these fertilizers were applied until June 12, when rot began. The seasons of 1872 and 1873 were noted at this particular locality for protracted droughts during June and July. In the fall of 1873 sixty acres were drained, by cutting ditches about two rods apart, and a coating of sand was spread over the vines. The outlets and feeding-ditches were opened to give free circulation of water, as well as thorough drainage. Where foliage was destroyed last year by the vine-worm there was very little fruit; where plaster was applied, with a layer of sand over it, the vines looked healthy and had new rootlets.

Several other plantations in the same vicinity were examined, including those of Mr. Miller and Mr. Rockwood. I visited Bricksburgh, Ocean County, July 24, accompanied by Messrs. E. W. Crane, A. J. Rider, J. Teller, I. Foster, F. M. Todd, C. Holman, Dr. Merriman, and W. S. Snyder, editor of the Times and Journal of Bricksburgh, and made an examination of several cranberry-plantations in this neighborhood, commencing with that of Dr. Merriman two miles southwest of the village. We found the berries very thickly set on the vines where the blossoms had not all disappeared, but traces of the rot were discernible. I made a careful examination of the nature of the soil, the roots of the vines, and the degree of acidity of the fruit from the different portions of the bog. Where guano had been applied a marked improvement of the foliage and roots was visible. In answer to an inquiry made by me whether any of the growers present had given attention to the con-

dition of the soil and of the roots of the vines, a unanimous answer was given in the negative. After our company was increased by Colonel Goodrich, of Stockbridge, Mass., and the Rev. A. H. Dashiel, of Bricksburgh, both of whom are interested in cranberry-culture, we visited the plantations of Mr. J. W. Campbell, the Rev. Isaac Todd, and Mr. Ferre, all being connected in one continuous plain. This extensive bog was formerly a mill-pond. The soil of such places is generally very favorable for cranberry-cultivation, and proved to be in this instance. These three plantations have never failed to produce healthy crops. An examination of the soil proved that the peaty matter of which it principally consists was well decomposed. Our attention was directed to one small portion of the pond where about two years ago the berries rotted. I examined this place by digging up the ground, and found that the soil was not well decomposed, and that the muck was in a condition of active fermentation, giving off strong odors of sulphureted hydrogen. The roots of the vines here were unusually large, matted, and of a dark, unhealthy color.

We next visited the plantation of Messrs. C. G. and E. W. Crane, at Long Swamp, consisting of about thirty acres. This plantation had been recently laid out, and was provided with the latest improvements. The ground here proved generally good, although in some places there were decided indications of sour, fermenting soil. Mr. D. B. Darrows's Onondago plantations were next examined. The soil here is of a mixed character, some portions of it proving to be well decomposed and without odor, while other portions were in a state of fermentation. It was observed that the rot was confined to the parts indicating fermenting soil, while the sound berries grew on the well-decomposed soil, which has generally a pleasant odor.

We next visited Butterfly Bridge plantation, laid out some years ago by Rev. F. M. Todd, in the best manner. The vines on this plantation rotted in spots last season. An examination of these spots showed undecomposed peat, and unhealthy roots, the latter being very large and closely matted. Having stated to the committee of cranberry-growers accompanying me that fermenting soil and stagnating water were probably the principal causes of the rot, I was informed that, although my theory held good thus far, there was a neglected cranberry-plantation, known as the Carey Bog, near Bricksburgh, the water of which they believed to be stagnant, as it had no visible outlet, but notwithstanding, the fruit of the bog had not been affected by the disease. An examination of the bog showed that the water which flooded it was perfectly fresh, being supplied probably by means of springs, and passed off through the sand. The whole surface was covered with a dense growth of moss and weeds, interspersed with cranberry-plants. The cranberry-roots were growing in the moss and confined to it. They were short, of a whitish color, and very healthy; sand to the depth of eight inches had at one time been spread over the peat-muck. I cut through it, and found it to be very pure and free from any odor. This bog very much resembles a wild bog, being wholly neglected. I have also examined the roots of the cranberry-plants as found growing in the wild state, and in all cases have found them to be healthy and similar to these. I have thus far failed to discover any healthy cranberry-vines growing in stagnant water.

I next visited the Berkeley plantation, one and a half miles from Tom's River, in company with General Morris, Dr. Merriman, and Messrs. S. H. Shreve and A. J. Rider. This plantation contains about fifty acres of vines, which appeared very promising. They had been planted about

nine years. The berries, at the date of our visit, were slightly affected with rot. On my first examination of the soil I detected imperfect roots, but no sulphureted hydrogen. On going deeper, the latter was found in abundance at a depth of about two feet six inches. The soil of this plantation is of the variety known in New Jersey as savanna, consisting of sand, with a slight trace of vegetable matter. An analysis made in the laboratory of this Department shows that the proportions are, sand, 97 parts; peaty matter, 3 parts. Mr. Shreve informed us that a layer of peat about two inches in thickness had been spread over the surface of the bog. From some cause this peaty matter was in a state of fermentation, and its odor very bad. We were informed that gas-lime had been spread over portions of this plantation with but little effect. In my opinion, the use of stone or shell quick-lime would, in this instance, produce more important results. The water in the ditches was highly impregnated with iron—probably a bicarbonate of iron—which is soluble in water. Gas-lime is composed mostly of sulphide of calcium; that is, a mixture of sulphur and calcium. It also contains caustic lime, but in limited quantity. When gas-lime is exposed for a considerable period to the action of rain and air, a large portion of the sulphide is converted into sulphate of lime, or land plaster, while the caustic lime is converted into carbonate.

We next visited the plantation of General Morris, of Bayville. His vines are of only four years' growth, and the cranberries have rotted each year. An examination of the peat revealed the presence of sulphureted hydrogen, which was also found in the substratum of the savanna bottoms of this plantation. One-half of the plantation was covered with sand taken from an adjoining cultivated field, the particles of which were very fine, and it probably contained clay. The vines covered with this fine sand were stunted in growth, while those sanded with coarse sand, taken from an uncultivated bank near by, were very thrifty and in full bearing. Samples of these two kinds of sand have been procured, and will be analyzed in the laboratory of the Department.

I also visited the plantation of Mr. A. T. Finn, of New York, consisting of thirteen acres. The vines appeared healthy and were fruited, although the berries were rotting. An examination of the soil of this bog revealed the presence of fermentation and unhealthy roots. We were informed that the vines last year appeared healthy, and yet the berries rotted so badly that but twenty-five bushels were harvested from thirteen acres.

We next visited a very thrifty bog, known as the Shreve plantation, near Tom's River. This bog has always borne fruit free from rot. An examination proved that all the conditions were favorable, the soil being well decomposed and free from odor, and the roots small and healthy in appearance. From this point I proceeded to West Creek, and visited the extensive and highly cultivated plantations of Mr. D. R. Gowdy, and also the Eagleswood Company plantation. I found here good and bad soil, plenty of water, and a refreshing cool breeze blowing over the surface of the grounds, the latter circumstance being of common occurrence. Mr. Gowdy claims to have a very superior short vine which is known as the "Gowdy vine." He is one of the oldest cultivators in the State and has been very successful. The land under cultivation at this place is generally good, although I found many spots on it in a state of fermentation.

A diversity of opinion seemed to prevail at this place between Mr. Gowdy and the Eagleswood Company as to the best form and depth of ditches and the width of the lands between them. The irrigation of cranberry-land is of the highest importance at all times, but especially

when the soil is sour. The Eagleswood Company lately ditched their bogs very deep, and on the day of my visit to their plantation I observed that the water in the ditches did not come within 18 inches of the roots. There were probably about five inches of sand over the peat-bottoms. I examined the roots of the vines and found them baking in pure, dry sand at a very high temperature. The overseer in charge informed me that they had been in that condition for some time, and that having no instruction to fill up the ditches with water he was powerless to act. This was probably the condition of about eighty acres during the hottest days of August last. The peat of this plantation is several feet in depth, (cedar bottom,) and is capable of still higher cultivation owing to the general mellow condition of the soil and its being well supplied with water. I do not consider that the extra depths of these ditches will prove injurious to the vines, provided they are supplied with substantial ditch-gates to enable the person in charge to regulate the height of water in the ditches at will.

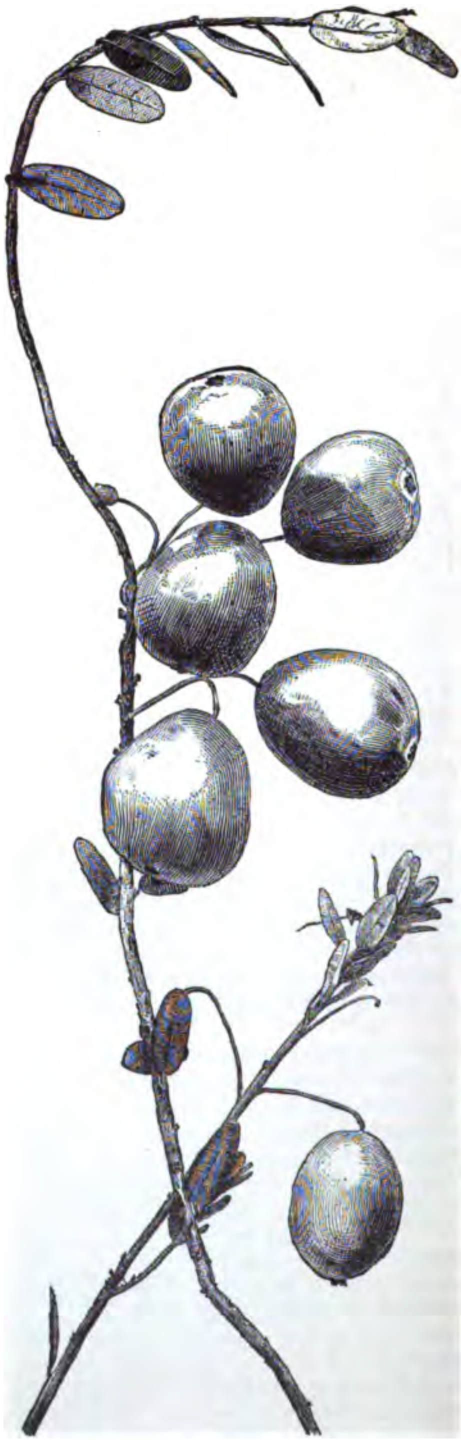
With the committee I next visited the bog of Mr. Goodell, near the village of Bricksburgh. The vines had been treated with a light sprinkling of lime over their surface for the last three years, and the proprietor believed that the treatment in question destroyed worms and modified the rot; but on looking over his grounds we found many examples of rotting berries. We dug up the first clump of vines upon which such berries were found. The roots were very large, and were matted and dark in color. At a few yards' distance from the first plants removed, we found a very healthy clump of vines, the berries of which were sound and of a good, acid taste. The roots of these vines were found to be very small, and much whiter than the first examined. On seeing this, Mr. Goodel, exclaimed, "Something wrong with the roots," although he was notl aware that I had already reached the same conclusion. He complained that the soil was frequently sour, and had sometimes the odor and taste of acid. I was frequently informed during the early part of my investigation that the cranberry on Cape Cod is not subject to rot. Indeed, persons from that section assured me that rot, or scald of the berry, is wholly unknown in that region. As the statements seemed trustworthy, I suggested to the cranberry-growers of New Jersey, that an examination of the conditions under which the cranberry-vine was said to be so successfully cultivated there, might lead to practical benefits. With this view I procured proper introductions to the leading cranberry-growers of that region, and proceeded to Cape Cod, arriving at Harwich Centre about the 26th of July. The first plantations visited were those of Captains Robins and Small, both extensive and experienced growers of cranberries. I also visited the plantations of Dr. Pitcher and others, at Hyannis. Contrary to expectations and reports, I found the rot of the cranberry to be well known on Cape Cod, and on just such soil and under the same general conditions as in the vicinity of Bricksburgh, N. J. Fermenting peat-bottom, or fermenting sanded grass-bogs, subject to back water, large matted roots, and berries either bitter or of the flavor of flat acid—such were the circumstances under which diseased berries were uniformly found. But, as in New Jersey, there are on Cape Cod very fine plantations free from disease. Although nearly all of the plantations of Captains Robins and Small indicated high cultivation, the favorable condition of their soil and surroundings had as much to do with the production of good crops as had the attention bestowed on them. Many patches which had proved a failure were pointed out to me during my investigations on Cape Cod, although in some cases more money had been wasted on them in bringing them under high cultiva-

tion than had been spent on the successful bogs. My examination has shown, thus far, that in every instance sour soil, high temperature, and large, dark, matted roots are the invariable attendants of rotting berries.

Much diversity of opinion exists on Cape Cod, as well as in New Jersey, as to the best kind of peat-bottoms to be used for cranberries. I have found successful cultivation of this crop on cedar and maple bottoms, the waters of which were charged with bicarbonate of iron in solution. Not unfrequently would the peat be found six feet in thickness. Captain Small has a successful plot, consisting of coarse, sharp sand, deeply colored with iron. The bed of sand is 18 inches in thickness, and rests on "hard-pan," a solid bed of bog-iron. Such iron-basins are formed from the precipitation of iron held in solution in the water which flows over the bog-land. Captain Small informed me that, on some parts of Cape Cod beach, cranberries grow successfully on pure sand when provided with an adequate and constant supply of peaty water. Much stress is placed on the quality of sand by all cranberry-growers. It is claimed by all with whom I have conversed on the subject, that coarse, clean, sharp sand is best adapted to the growth of the vines, and my own experience coincides with this view. In some cases only an inch of sand is placed over a peat-bottom, and then it is planted with vines, the roots growing directly in the muck. In other cases as many as 10 inches of sand have been placed over the muck or peat, the growth of roots in such cases being confined wholly to the sand, which, however, conveys the soluble humus of the peat to the roots of the plants. There is always a rankness of root and vine-growth when the vines are planted directly in peat, and as the growth of plants is continued longer under such conditions, they are longer in bearing their fruit. The same remarks apply to plants which are heavily manured, and constantly supplied with an abundance of water. I have found in every case where the runners have been sanded to the depth of about an inch, and properly watered, they readily take root in the fresh sand and produce a fine growth of lateral branches. It has been found in some cases that sanding the vines in this way has as good an effect on their growth as an application of guano. Several small cranberry-plantations were pointed out to me which had, at various times, been flooded with salt water, not only on Cape Cod, but also in New Jersey; but there was no evidence to show that salt sea-water, reduced in strength by heavy rains, affected the growth of the vines for good or evil.

It is believed by many successful cranberry-growers that the runners of the vines should be sanded at least once in four years when practicable, and some growers sand them as often as once in three years. The great advantage derived from the sanding process consists in the stimulating of new roots along all the runners imbedded in the sand; and it seems from my investigation that the original roots decay in consequence of the vigor of the new ones; but the sand also protects the runners from extreme heat and premature frost.

At the Bricksburgh annual meeting of the Cranberry-Growers' Association, I was informed by gentlemen from Pemberton and its vicinity, that the plantations in their neighborhood differ very much from all I had visited. Their soil is savanna, and is very dry in most places, and previous to the last three years their berries had not rotted. I was further informed that Mr. Hinchman's plantation, near Medford, presented conditions which apparently could be found on no other, his vines being more copiously watered than any I had yet seen, while his berries



Long cranberry-vine, (New Jersey.)

were exempt from the rot. At the earnest request of members of the association I visited this plantation, and those in the vicinity of Pemberton above referred to, as well as that of Mr. N. H. Bishop, near Manahawkin, Ocean County, in order to obtain additional facts in regard to the habits of the cranberry-plant under new and exceptional methods of culture.

I found the plantations of Mr. Bishop, which embrace about 80 acres, in a very high state of cultivation. This gentleman has probably expended a larger amount per acre, and devoted more attention to the preparation of his bogs, than any other cranberry-grower in the United States. He is regarded by all the New Jersey cranberry-growers as one of the most zealous, clear-headed, and successful of their number. Practically, rot is unknown on his bogs. In company with Mr. Bishop and others, I made a thorough examination of his vines and berries, and also of the muck underlying his cultivated ridges. The peat is about five feet in thickness, is well decomposed, and quite homogeneous in texture. The bog was formerly a white-cedar swamp. Mr. Bishop is fortunate in having a fine supply of water. Cool and uninterrupted breezes pass over his plantations, a circumstance of considerable importance in connection with cranberry-culture. It was, doubtless, largely due to these favorable conditions that the extreme heat and drought of last August and September produced no unfavorable effect upon his crops. I examined the muck or peat of an adjacent bog, belonging to the same gentleman, which had dried up during the summer, but had not been drained or brought under cultivation. A hole was dug about three feet in depth to ascertain the character of the subsoil. We found it as free from odor as the cultivated bog-land, and as well decomposed. It was evident that nearly all the muck of this cedar-swamp had long since passed through its fermenting condition. The cultivated land is perfectly drained, and the ditches are filled with running water. Mr. Bishop has put an unusually large amount of pure sand, not less than 10 inches, over the muck of his bogs. The roots of the vines consequently grow in the sand, which, by capillary attraction, conveys to them the soluble humus of the peat.

The true character of the peat in relation to cranberry-growth is still a matter of doubt; but one thing is evident, namely, that such masses of peat will always absorb and retain a large amount of water, and will thus tend to keep the sand on the top moist. Certainly the humus of the peat is not itself absorbed by the roots of plants, but humic acid is seldom free from ammonia, and the oxidation of peaty matter may also contribute to root and plant growth by supplying carbonic acid, which is one of the essentials of plant-food.

In company with Senator Gaskill, and Messrs. Theodore Budd, Joshua Forsyth, Japhet Alston, David D. Coles, Ives Davis, and others, all engaged in cranberry-growing, I visited the principal plantations within several miles of Pemberton. Drought had disastrously affected this region. Pines were on fire in many places and burning with great fury, owing to their extreme dryness. The streams had dried up, with few exceptions, and no water was found within five feet of the surface on the cranberry-lands. There is very little heavy bog-land in this district; it is nearly all of savanna, usually called black sand, composed of pure, sharp, white sand, combined with about 3 per cent. of black vegetable matter. Sometimes cranberry-cultivators at this place cover the runners with pure white sand. During very high temperatures, it protects, in a measure, the roots of the vines from the scorching rays of the sun. I found the white sand on the vines so hot that it was disagreeable to

hold in the hand, but the black sand near the same place was still hotter, and the cranberries on the vines were literally baked. Previous to visiting this district, I had not admitted that rot of the berry was ever produced by a scorching sun, but I now have sufficient evidence of that fact.

On the 9th of September I visited the cranberry-plantations of Joseph C. Hinchman, at Taunton, near Medford, Burlington County. They are subdivided into several plats, which are peculiarly and favorably situated for cranberry-culture. A stream of pure cold water flows through all his plats, most of which are nearly surrounded by high banks. From these ooze unseen currents of water, which moisten the cranberry-plats below them. The stream which flows through Mr. Hinchman's principal bog is about three feet deep and twelve feet wide, and is slightly tinged with soluble humus (peaty matter) and bicarbonate of iron. In several of the bogs there are sulphur springs, one of which flows in the middle of a cranberry-plat without doing any apparent injury to the plants. It may be remarked that Mr. Hinchman's cranberry-vines, although cultivated, are growing in water as if in a wild bog. The condition of his bog-land vines and berries at once demonstrates that the cranberry-vine may be brought to a high state of cultivation, although the roots may be submerged in water the year round. Many valuable experiments have been made by Mr. Hinchman to ascertain how much drainage may be profitably employed, and the description of sand, as well as the amount per acre, that should be used on bog-land previous to the planting of vines; also, how much should be laid over the vines when in full growth.

I think that the Taunton plantations would be very little improved by the use of lime, while on the driest portions of them a much larger yield of fruit would be obtained by the free use of fertilizers applied after the removal of the water of the winter flooding. On the margin of these plantations Mr. Hinchman has erected an extensive building of stone for the assorting, cooling, and storage of berries. Cylinders are supplied with an ice-mixture, through which cooled air is carried by means of suitable machinery over and through the crates of berries awaiting transportation.

This is the only place in the United States where machinery is employed to cleanse, cool, and assort the berries previous to shipment. The important fact was established by my visit to Mr. Hinchman's bogs that the cranberry-vines are not injuriously affected, even though the roots may be submerged from one to two inches, provided the water is cool and in motion. Mr. Hinchman's plantations possess greater natural advantages than those of Mr. Bishop, but he will, notwithstanding, have a smaller crop per acre than that gentleman, and his berries will ripen later. While walking over the Taunton vines my feet were frequently in two inches of water, and the use of rubber boots was indispensable, while the surface of the plantations at Manahawkin was comparatively dry. Under the wet system the vines have a greater tendency to extend in woody growth. The blossoms are consequently later in forming, and the berries later in maturing, than under the drier system of culture; but in a series of years the wet system might prove more profitable than the other, since it affords a better protection against grasshoppers, and also the berry and vine worm. These pests are unknown on Mr. Hinchman's bogs. An analysis of the berries cultivated under each system would probably show that those from the wet plantations contain less earthy and solid matter generally than those from the dry, and, all other conditions being equal, would probably keep better

than the former. A recent analysis of Captain Small's Cape Cod Early Black Bell berries gave one-fifth of 1 per cent. of earthy matter, while the common Cape Cod Bell berries of good quality gave about one-fourth of 1 per cent.

The system of sanding cranberry-land is greatly varied. On Cape Cod the cultivators take advantage of their extremely cold winters. When their bogs are covered with ice of sufficient thickness to bear a horse and wagon, sand is carted over it and spread to the thickness required. When the ice melts, the sand is deposited evenly over the vines, at a cost of ten to fifteen dollars per acre, for one inch in thickness. In Southern New Jersey this system of sanding can seldom be practiced, owing to the mildness of its winter. Mr. Theodore Budd, of Pemberton, N. J., informed me that in his neighborhood a layer of sand one inch thick can be spread over an acre of vines at a cost of $20, provided labor does not exceed $1.50 per day of ten hours, and when the sand is procured on the edge of the bog to be covered. On large plantations, consisting of one hundred to three hundred acres, a layer of sand one inch thick will cost from $40 to $60 per acre. The cost will, of course, vary according to the distance of transportation.

The cranberry-growers of New Jersey are very much divided in opinion as to the amount of water that should flow in the ditches of their bogs when the berries are coloring under high atmospheric temperature. Some believe that excessive moisture and high temperature cause the berries to rot, while others equally intelligent affirm the opposite. Much of this uncertainty arises from the limited quantity of water furnished at the fountain-head of many of the bogs under cultivation. A small stream will quickly fill the ditches of a 10-acre lot when stops or gates are used; but, during high temperatures, the water becomes quickly heated, and instead of proving beneficial will prove hurtful to the vines, especially when the subsoil has not been well decomposed. Under such conditions fermentation will be promoted, producing organic acids and sulphureted hydrogen in the vicinity of the roots, while a much larger flow of water in the ditches would cool the substratum of the bogs, and remove, at the same time, all soluble noxious substances.

At the Taunton plantation, Mr. Hinchman introduced a novel system of washing sand over his bog-land by means of a stream of water conveyed for that purpose along the base of the high sand-bluffs which nearly surround his plats of cranberry-vines. I am informed by Mr. Hinchman that by the use of this system sand was washed over his lands at the rate of ten tons per minute. In this way a kind of sand charged with ocherous clay (which is at present deemed worthless for cranberry-culture) may be used, as the water floats and separates the clay from the sand, depositing the latter on the vines, while the clay is washed away in the main stream, which was highly colored in consequence at a distance of ten miles below the point of operation.

Before investing in cranberry-culture, more attention should be paid to the condition of the soil than has heretofore been done; for on that depends the quantity of water necessarily required for the purposes of irrigation. When water is very limited in supply, it should be protected from the sun's rays in some practicable way. Small ponds or dams used as reservoirs might be protected by shade-trees, and in many cases streams might be easily protected in this way. On my last visit to Bricksburgh, September 12, in company with Dr. Merriman of that place, we visited one of his plantations for the purpose of testing the difference of temperature of the waters at different parts of the bog.

The stream which supplied several acres with water was so small that it might have been all conveyed at the time of our visit through a 10-inch pipe. It entered the bog from a ditch four feet in depth. A thermometer when immersed in it indicated 72° Fahr. The water being somewhat protected from the sun's rays, the temperature at the exposed edge of the ditch at the same point was 90° Fahr. At a distance of a hundred yards farther on, where the water was fully exposed to the sun's rays, the temperature indicated 89° Fahr. Shaded water in a ditch a hundred yards still farther removed from the first ditch had the temperature of 78° Fahr., while the sand on the exposed edge of the ditch showed a temperature of 92° Fahr. These observations were taken at 4.30 p. m.

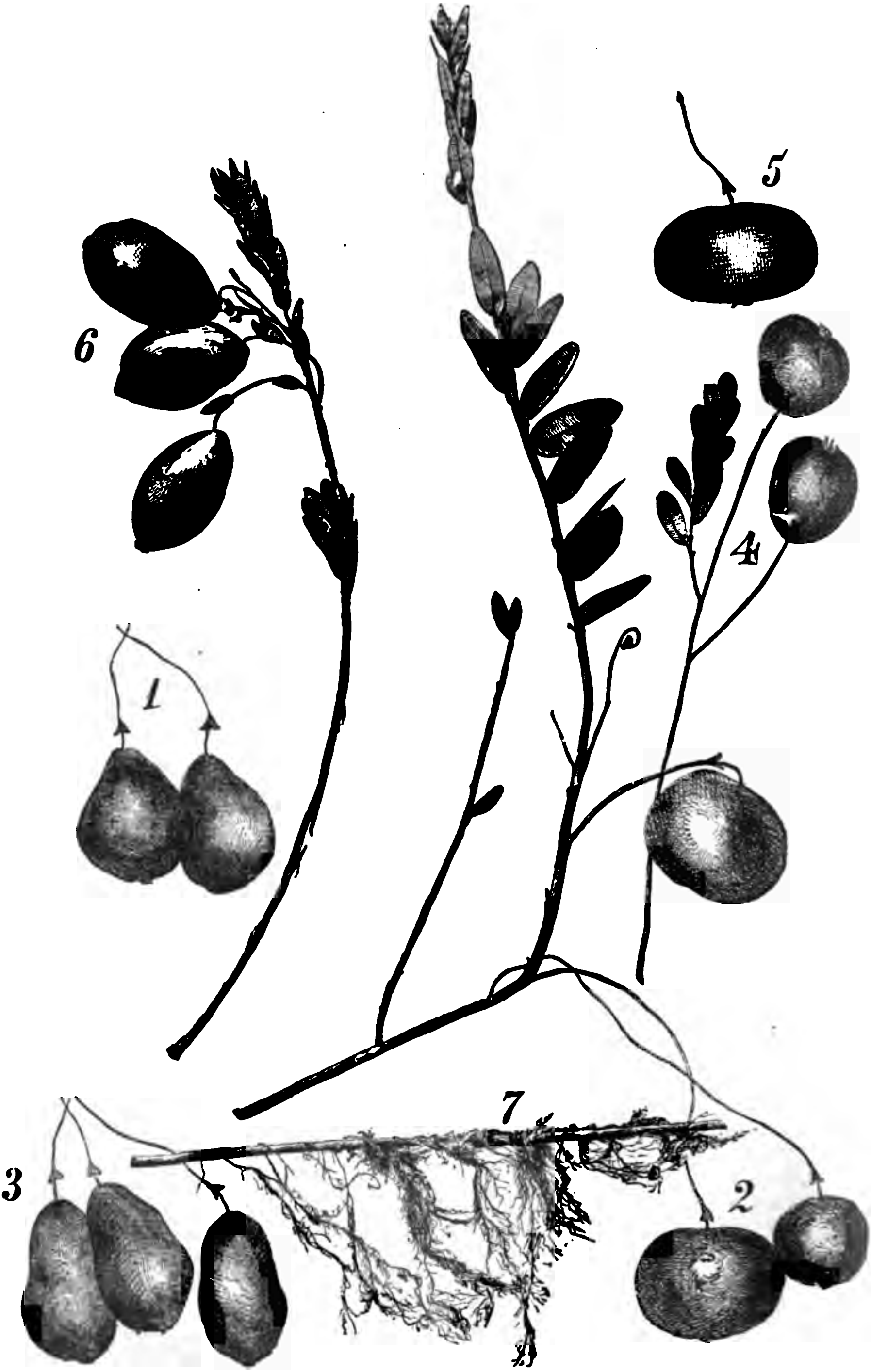
In returning from Bricksburgh, I visited the plantation of the Atlantic Cranberry Company, near Elwood, Hamilton Township, in company with two of the directors, General Wright and Mr. C. R. Caldwell. This plantation consists of about 300 acres, and was formerly a wild-cranberry swamp. It was brought under cultivation within the last six years, but thus far has proved unprofitable to the stockholders. I found, on making an examination, that the *roots* of the vines were very much matted, and in massive clumps. Evidently the vines had been planted after the same manner, in large bunches.

Four plants in hills, 12 inches apart, would give better satisfaction than twelve plants in a hill, with the hills two feet apart. The matting of the vines would be sooner effected by the former method, while the matting of the roots would be avoided. It is important that the ground be covered with vines as early as possible, as they prevent the growth of weeds, and in some cases uproot them. The cranberries on this plantation are remarkable for their sweetness, which is not an indication of a healthy condition. Water is very deficient on this plantation, although there is an abundance within a short distance.

It will be necessary, in my opinion, to procure a large and constant supply of water to insure success, although the ground, according to my examination, is in a very healthy condition, being free from bad odors; but it will not remain long in this condition, without a perfect system of irrigation. A continuous movement of the water is necessary to remove the soluble, injurious substances which always accumulate during vegetable growth and decomposition. Stagnant water favors the growth of infusorial and cryptogamic life, which is highly injurious to the health of plants of high organization.

The cranberry in the green state, and when growing vigorously under comparatively low temperature, is charged with starch granules, which are easily seen by the use of the microscope under a power of about 300 diameters, especially when stained blue with iodine. Rain, moisture, moderate temperature, and healthy soil cause a great increase in the size of cranberries without rotting them, but a deficiency of moisture and premature high temperatures, convert their delicate cellulose and pure starch into an excess of glucose, being really a chemical process, in which the plant does not take the least part. The production of grape-sugar in the berry is probably the next process toward its destruction by inducing fermentation.

This plantation stands greatly in need of irrigation, redistribution of the plants in many places, and sanding to the depth of at least one inch. Land-plaster would improve the land by stimulating new root and vine growth; it also absorbs moisture from the atmosphere, without combining chemically with the plaster, and is therefore of more value to the vine in this respect than common burnt shell or rock lime, but the latter have their value as acid-neutralizers, "sweetening the soil."



Cultivated varieties, (New Jersey.)

The inquiry has frequently been made, whether cranberries can be raised from seed by artificial culture. Mr. Joseph C. Hinchman showed me about one-sixth of an acre of vines, which he had grown from seed. Having a large quantity of rotting cranberries, he decided to have them ground coarsely in a mill, taking care not to bruise the seed. The pulp was spread with a shovel thickly over a marshy piece of ground well protected by high banks. The seeds germinated the following spring, and on the third summer the vine had formed a profuse matting, and yielded a small quantity of fruit; the acid of the fruit had a good flavor, and a taste slightly bitter. Neither the berries nor vines had been affected by worms. The part of the bog on which the seeds were planted was abundantly supplied with cool, running water. I have been informed by several cranberry-growers, that they had endeavored to raise vines from cranberry-seed, but had always failed. The many varieties of cranberries found on plantations show that plants may be successfully grown from seed, when the conditions are favorable for their germination.

About a century ago, on the lands owned by the Haskins family, of Dorchester County, Maryland, some cranberries brought down by one of the regular coasting-vessels owned by Sir William Pepperell of Piscataqua River, (the Hero of Louisburg,) were thrown on the shores of the Choptank River, from which grew an excellant crop of vines which gave value and character to the place for several generations of owners.

The following extract from a letter to the Commissioner of Agriculture, relating to the profits of cranberry-culture, has a general interest:

MANAHAWKIN, N. J., *November* 3, 1874.

In reply to your request, I would say that I have about 400 acres of cedar-swamp bottom in this township. At Oxycoccus, my old plantation, there are about 80 acres; 22 acres are in cultivation, 18 acres in full bearing-order.

	Bushels.
The crop of 1871, on 18 acres, was	1,800
The crop of 1872, on 18 acres, was	2,700
The crop of 1873, on 18 acres, was	3,000
The crop of 1874, on 18 acres, was	1,700
Total number of bushels	9,200

My Mayeta plantation contains 100 acres fine cedar-swamp bottom, of which nine acres were planted last spring. There I have canals for the purpose of conveying pickers and berries on and off the beds by water, in scows. These plantations, Oxyccocus and Mayeta, can both be irrigated the ditches serving as well for drainage as irrigation. From one acre I had what our growers call the largest yield known from a single acre. When the vines were only three years old, I harvested 225 heaped bushels of cranberries. The next year, 451. The following season, 375. The next year, 1874, 275.

The 451 bushels, the crop of a single season on one acre, were sold by C. P. Knight & Bros., 114 South Wharves, Philadelphia, for $1,804.

The acre referred to in this letter cost about $800, including land (dam) flooding, and all expenses to bring it into bearing-order.

N. H. BISHOP.

We annex the following from French & Co.'s valuabl Annual Cranberry-Circular:

The recent statistical report of N. R. French to the New Jersey Cranberry-Growers' Association shows the entire acreage in New Jersey, under regular cultivation, to be 4,969 acres. Average cost at three years from setting, (the fruit-bearing age,) $334.50 per acre, making the total investment $1,662,130. Crops in this State have been, in 1871, 58,839 bushels; in 1872, 93,322 bushels; 1873, 116,409 bushels. The average market-prices have been in the years named, $3.42, $3.21, $2.93, respectively. Abating $1 per bushel from market-price for cost of picking and marketing, would make the crop of 1873 worth, on the vines, $224,716, or 13½ per cent. on the entire investment.

The New Jersey fruitage in 1873 was most bountiful, but 40 to 50 per cent. was destroyed by the rot. This season the average fruitage upon old plantations is believed to be 30 to 40 per cent. below last year, but the rot on these has not been so severe. New bogs have suf-

fered most, as usual, the entire crop in many cases being lost. Allowing for increase of acreage, we think the entire crop of the State must be 25 per cent. below that of a year ago.

The crop on the eastern portion of Cape Cod is very light, and in many districts almost an entire failure. The western portion and the adjoining islands have good crops. Nearly all the other cranberry-districts of Massachusetts and Rhode Island have good crops. The few plantations on Long Island and other portions of New York have good crops. The fruit not affected by rot seems sound and solid, promising to keep well.

Mr. Joseph J. White, author of an interesting work on cranberry-culture, and himself largely interested in the business, visited the Atlantic Company's plantation a short time before my examination of it. As his report is of general as well as of special interest to cranberry-growers, I submit the following extract from it:

NEW LISBON, N. J., *Ninthmonth* 16, 1874.

GENTLEMEN: Agreeably to your request, I submit the following report relative to the "water-supply" of the Atlantic Company for the culture of cranberries:

Your plantation becomes too dry during the summer, in consequence of your thorough system of ditching, and the absence of all spring water. This lack of moisture during a portion of June, July, and August was doubtless the cause of its failure. Without thorough ditching you could not have obtained the beautiful mat of vines you now have. *The ditches are essential*, and should be kept open and free from all obstructions from the time the flood is drawn in the spring, say May 1 to about June 20, when the water should be raised in all the ditches to within 4 or 5 inches of the surface, and be so kept until about the 1st or 10th of September, depending upon the weather. It should then be allowed to escape, and the ditches be thoroughly cleared of all obstructions until the time of flooding. This will insure you a good spring and fall growth of vines; and, if the whole area is irrigated as above described, you will probably obtain good crops.

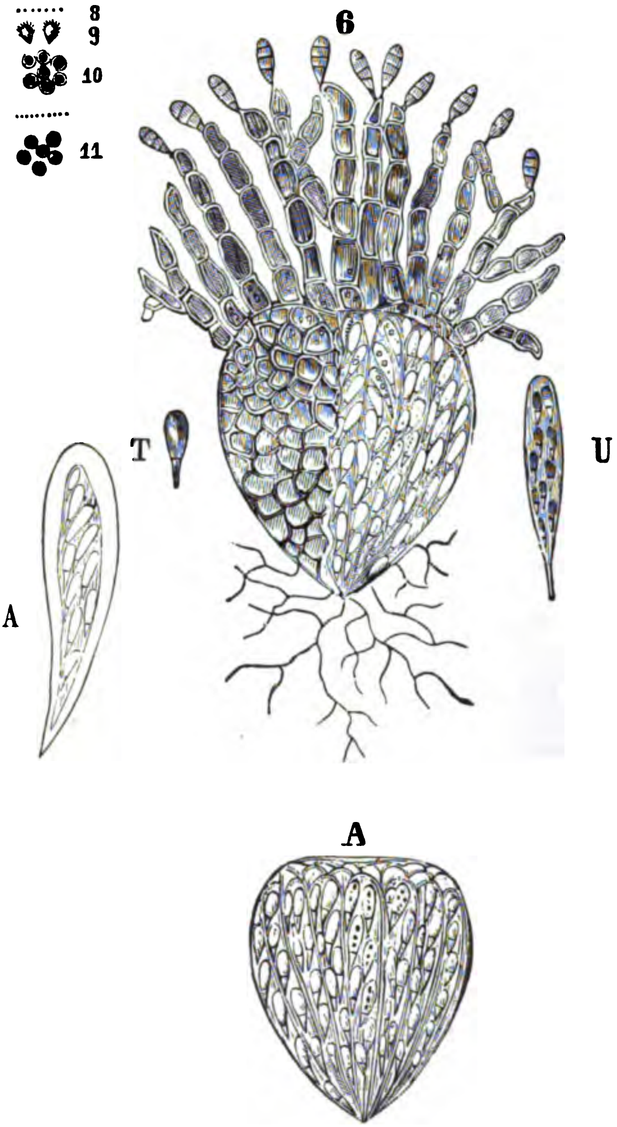
While irrigating your meadow you *should not* raise the water over the surface of the ground, but, where necessary, dig small irrigation-ditches about one foot wide and one foot deep. Irrigation-ditches should not be more than three rods apart. Whatever plan you adopt for obtaining a supply of water, you should calculate upon a very considerable expenditure of money for the construction of numerous small gates or obstructions in the main ditches and the irrigation-ditches, as above described.

In view of the large area under cultivation, it is of importance that you should arrange your obstructions in the principal ditches so that they may be quickly opened, otherwise your vines might be partially flooded by a freshet, and the berries scalded shortly afterward by excessive heat. Such calamities have frequently occurred, and, as a rule, it is never safe to allow water to rise over the surface of a cranberry meadow during summer. Probably the best plan of irrigating is frequently to raise and lower the water in the ditches, but I have no doubt that 500,000 gallons daily emptied into your ditches, arranged and managed as above described, will produce good results.

The next and most important matter of inquiry is as to what are the best means of obtaining a proper supply of water for irrigation. The plan of erecting dams, as described and recommended in your report on "water-supply," has its advantages, but it is open to objections, saying nothing of the expense of the plan. The practicability of holding water in the described pond, throughout an ordinarily-dry summer, is exceedingly doubtful. John C. Trautwine, civil engineer, and author of several standard works on engineering, says: "The total average loss by evaporation, filtration, and leakage from reservoirs of moderate depth, in case the earthen dams are constructed with proper care, and well settled by time, will not exceed above one-half to one inch per day, but in new ones it will usually be considerably greater." The filtration and leakage through your sandy soil would probably cause the loss to reach one inch per day. Allowing no water to escape through the flood-gates, the loss during the three summer months would amount to 7 feet 6 inches in depth, which would be sufficient, during an average season, to exhaust the pond. Then you may properly estimate the value of summer rain-fall. I give it for the last six years, as observed by T. J. Beans, principal correspondent of the Department of Agriculture for Burlington County, New Jersey:

Rain-fall.

Year.	June.	July.	August.
	Inches.	*Inches.*	*Inches.*
1869	4.95	1.98	1.26
1870	2.80	3.51	3.69
1871	6.11	6.22	6.82
1872	3.84	7.20	3.76
1873	1.70	6.97	9.29
1874	2.20	2.75	



Black-knot.
(Sphæria morbosa, *Schweinitz.*)

During a dry season, a few days only are necessary to dissipate the rain-fall of three months. In view, therefore, of all the facts, I think the cheapest and best method of obtaining a supply of water for irrigating your plantation will be to dig four wells, in line, at right angles to the natural drainage of the country, and about 5 rods apart. Let each of the wells be 8 feet in diameter, and of sufficient depth to afford in the aggregate 1,000,000 gallons per day. The wells should be arranged in a straight line, with an engine in the center, having sufficient power to raise 1,000,000 gallons 100 feet high in twenty-four hours. The engine might be used for raising earth, pumping, &c., while sinking the wells. If it is found that four wells are necessary to afford 1,000,000 gallons per day, a lift-pump, with a capacity for raising 250,000 gallons 100 feet in twenty-four hours, should be placed 30 feet from the bottom of each well, the four pumps being worked simultaneously by one line of shafting. Four wells will yield much more water than one of similar capacity, for obvious reasons.

As 1,000,000 gallons would fill all your ditches once, a supply of 500,000 gallons per day would doubtless keep all the ditches you now have, and all the irrigation-ditches you will hereafter dig, full at all times. One well 8 feet in diameter and 100 feet deep I estimate to cost—

For digging 100 feet, at $3 per foot	$300 00
For 45,300 bricks, for wall 8 inches thick, delivered, at $12 per thousand	543 60
For laying up wall	100 00
For incidentals	100 00
Total for one well	1,043 60
For four wells	4,174 40

To this will be added cost of engine-house, engine, pumps, and shafting. I would not recommend you to use the "centrifugal" pump for this, as it is more especially adapted to moving large bodies of water a short height.

Wishing you success in all your undertakings, I am, very respectfully, &c.,

JOSEPH J. WHITE.

Messrs. E. WRIGHT and GEO. W. RICH.

With reference to the accompanying illustrations:

Plate 1 represents what is known as the "Short Gowdy cranberry" vine.

Plate 2 represents the *long vine* the third summer after planting. The berries of young vines are generally larger, more fleshy than those of older vines, and are therefore disposed of as early in the season as practicable, being liable to ferment.

Plate 3 represents a variety of modified forms of the cranberry. 1. The bell. 2. The cherry. 3. The bugle. 4. The red early bell from Cape Cod as found growing in New Jersey. 5. The cheese berry. 6. A modification of the bugle. 7. Roots of the healthy vine intermingled with moss.

BLACK-KNOT OF PLUM AND CHERRY TREES.—Having received from a gentleman of New Jersey, Mr. Abram McMurtrie, some excellent specimens of black-knot taken from plum and cherry trees of different ages, I resumed my investigations of that disease with very satisfactory results. A portion of the fungus being removed from a specimen of the black-knot which had grown on a plum-tree about seven years old, and being submitted to an examination by the microscope, at a very low power, exhibited forms of fruit (perithecia) as seen at 8. When viewed in section by a higher power, it appears as at 9; and in top view as at 10, showing an indentation in each perithecium.

When a perfect specimen, as seen at 9 or 10, is submitted to the action of nitro-muriatic acid for about thirty minutes, a slight decomposition of the acid takes place, indicating that the resinous or oily matter of the perithecium becomes oxidized. These strong mineral acids have no destructive action on the organic structure of the perithecium, although they have the property of bleaching it in some degree, thus rendering it translucent, and making its cellular structure visible. If ammonia is applied in drops to the specimens, after having been treated with acids,

their albuminoids become pliable. This process is especially valuable when applied to matured and dry specimens. Fig. 6 represents a very highly magnified perithecium, a part of which is in section, and represents the internal arrangement of the asci and sporidia in them. From my recent experiments on black-knot I am now able to demonstrate its structure. If a perfect perithecium, which has been treated with acid and ammonia, as previously described, is gently bruised on a microscopic-glass slide, by any of the well-known modes, the asci containing the true sporidia will escape, and frequently the sporidia will be seen in profusion on the glass. I have counted as many as ten sporidia in one ascus. When the perithecium is very pliable, and the interior mass of asci well matured, it may be entirely removed by pressure, as represented at A. A power of about 600 diameters is necessary to see it properly.

An ascus measures about the one-thousandth of an inch in diameter, and is about seven times its diameter in length.

If an ascus is treated with an alcoholic solution of iodine, containing a few drops of nitric acid, its nitrogenous matter becomes stained of a dark amber, while the sporidia retain their natural color. The asci will frequently exhibit, when treated with acids and alkalies, an expanded membrane of very delicate texture and quite transparent, as exhibited at A. T represents a sporidium; U an ascus showing the sporidia contained in it.

The true cause of this disease is unknown at present. My future investigations will be principally confined to its mode of propagation. Investigations of this character lose much of their value when they are confined to the microscope and laboratory. Districts affected with the dreaded pest should be visited, and the roots of the trees and their branches examined, that the investigator may become acquainted with all the stages of growth of the fungus, and thus ascertain how the disease is propagated.

THE FUNGUS ERYSIPHE TUCKERI.—On the 15th of May last, one of the foreign grape-vines of the experimental grapery of the Department was found to be affected with the fungus called *Oidium Tuckeri*. It first appeared on the leaves, then on the green branches, and finally on the fruit.

I determined to take advantage of its presence to make further investigations in reference to its habits. I secured on a glass slide a few of its Oidium spores, placed them in a clean-glass jar containing a little water, excluded the atmosphere by a ground-glass stopper, and subjected the jar to a temperture of about 75° Fahr. during the investigations. On the second day the spores were examined, when it was found that many of them had germinated.

1, group A, represents the Oidium. I think that the spores in this case are thrown out from the peduncle* in the same manner as soap-bubbles from a pipe. I have never seen a case of an Oidium spore having a small spore attached to it as if in the act of reproducing a *fac simile* of itself, as is so frequently observed in the spores of the common yeast-plant, (*Torula cerevisiæ.*) The Oidium spores germinated, and threw out branches, as shown in the drawings, 2, 3, and 4. The protruding branch of spore 2 differs in form from that of 3. The branched state of 4 illustrates the changes which take place in 2. I have observed many spores germinating like 3, upon the functions of which I have been unable to decide. After exposure for a few days, more new forms

* The stem or stalk that supports the flower and fruit of a plant.

of fungi appeared on the branches of the mycelium of the Oidium. (See 5 and its ramifications, group B.) Nos. 6 and 7 next appeared, followed by 8 and 9; 10 represents a highly-magnified spore of *Penicillium glaucum*, 9; 11, the spores of 7, germinating, which resemble *Penicillium Armeniacum*, Berk. The flask-shaped spores, 8, (*Antennaria tenuis*, Ness.,) are generally the last to appear. They belong to a genus of *Torulacei*, remarkable for their close resemblance to a Florence flask.*

My object was to ascertain what changes, if any, would take place during the germination of the spores. I therefore varied my experiments in numerous ways, and am satisfied that the forms 6, 7, 8, and 9 have no relation to the Oidium under experiment, but are distinct fermenting plants, living on and consuming the mycelium and spores of the Oidium, preventing the further healthy growth of the vine fungus. The facts observed have an important bearing on the cultivation of foreign grape-vines when grown in moist hot-houses, for since it has been shown that parasitic fungi are nourished by the spores and mycelium of the Oidium of the vine, and grow profusely on them, the vine itself will become affected by the growth of the fungi over its leaves, green branches, and fruit. I have frequently transferred to varnished glass slides the same class of spores direct from a leaf which had been kept unusually moist while growing. These will doubtless hasten the death of the plant on which they grow. The evidence is conclusive that when the flowers of sulphur have been applied early to mildewed vines, they have been saved, and that later applications have been unavailing. This may arise from the fact that the other forms of fungi, such as I have pointed out, may assist in the destructive work. These experiments have been repeated often under varied conditions, with an unvarying similarity of results. A slip of glass was varnished, and, when nearly dry, a vine-leaf covered with the Oidium was pressed on it, so that many of the spores adhered to the varnish. When the slip was introduced into a moist jar at the temperature mentioned, the spores adhering to the varnish germinated, as shown at B. When placed in an atmosphere containing turpentine, benzine, or carbolic acid, they failed to germinate, and the distorted forms of the Oidium were clearly seen, showing the destructive action of these substances on fungus-germs.

I next placed the dust of roll sulphur on Oidium spores, and also the dust of the flowers of sulphur on a second lot, each set being secured on glass slides, an inch and a half wide by six inches long.

These slides were subjected to moisture and heat, as before, in separate jars. After the usual exposure, it was observed that the same fungus forms of group B appeared on the germinating Oidium.

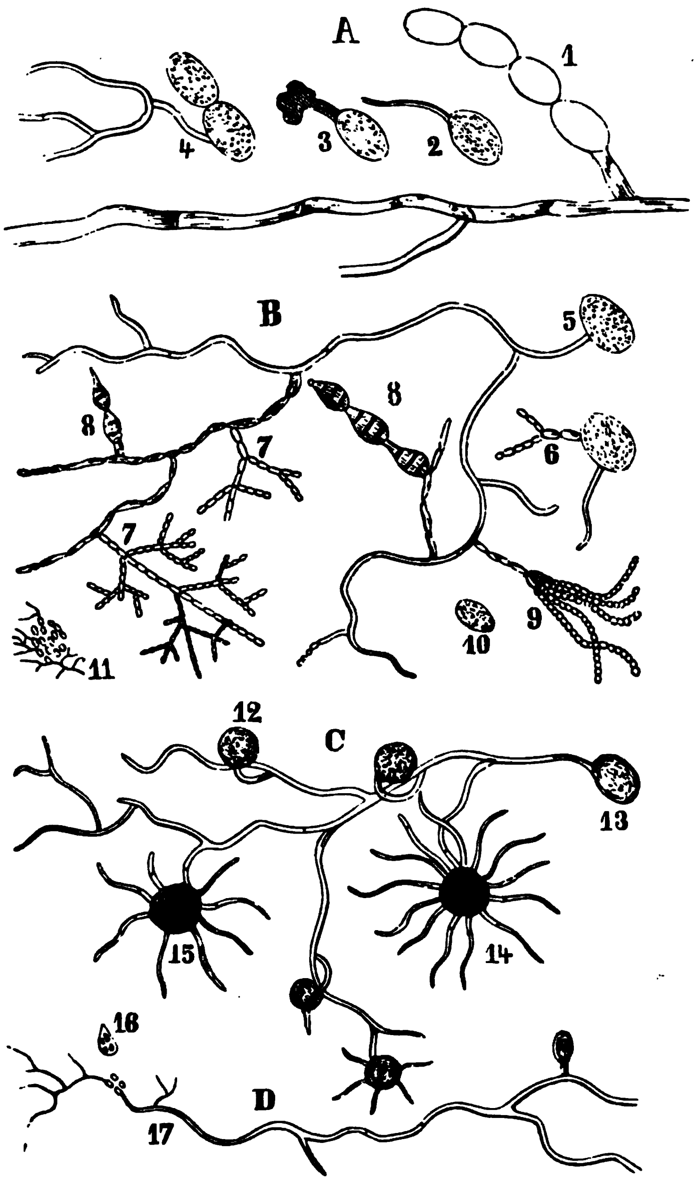
These results were not expected, as it has been generally supposed that sulphur is a perfect preventive of fungoid growth. This led me to test the effectiveness of sulphur for that purpose. I placed in an eight-ounce jar four ounces of pure water, one ounce of green peach-leaves, and two ounces of the flowers of sulphur, and subjected the whole to a temperature of 75° to 80° F. In three days fermentation commenced in full force, giving off a strong odor of sulphureted hydrogen. In the course of ten days the leaves were completely destroyed by the fermentation, demonstrating that, if the flowers of sulphur are anti-fungoid, the beneficial results of its application have not been due, as has been supposed, to its chemical qualities, but, probably, to its absorption of moisture.

*Griffith and Henfrey's Micrographic Dictionary says of this genus: "No British representatives of this genus appear to have been recorded hitherto." (P. 29, vol. 1, second edition, 1860.)

These experiments also go to show that the vine fungus is a true parasite, and that it will not fruit when removed from the plant on which it grows. A peculiar condition of the atmosphere may also be necessary. The Oidium form of the fungus is not supposed by mycologists to be a true mold, but merely a condition of a species of Erysiphe. Group B represents a theoretical view of its supposed condition; 12, 13, and 14, its stages of fruiting. Figs. 14 and 15 are filled with little sacs containing sporidia which germinate. Fig. 16, group D, represents one of them, and 17, a branch of mycelium growing from them, on which grows the Oidium.

It is stated on good authority that the fruit of this fungus has not been seen on the vine in Europe. In the fall and summer of 1871 and also 1872, I found specimens of its perfect fruit in great profusion on the foreign vine of the grapery of the Department. During the last two years, 1873 and 1874, not a single specimen of fruit could be found. Late in the fall of 1872, Mr. William Saunders, superintendent of the experimental gardens, had all the branches of the foreign vines in the grapery painted with a mixture of clay and carbolic acid, for the purpose of destroying the fruit of the vine fungus. Future observations may show that such treatment will prevent, in a measure, the ravages of the vine fungus. It has long been observed that very dry seasons are favorable to the growth of the Erysiphe fungus. Although a hundred foreign vines were exposed to the Oidium in the same grapery, very few were affected by it during the last season; and it is observed that the mildew is confined to certain varieties. The black Hamburgh, for example, was not affected at all by it, although growing side by side with mildewed vines. The green wood is always more injured by the Oidium than the ripe; consequently, as some varieties of vines ripen sooner than others under the same conditions, so the green branches of the later varieties will probably be more affected than those of the early. It was shown by my paper on the fungus of the American grape-vine, in the Annual Report of the Department for 1871, that the early spring leaves of American grape-vines are not affected by the mildew (*Peronospora viticola*) during the summer months, under ordinary conditions, although the leaves that sprout in summer, particularly during rainy weather, when sappy and of a very light-green color, are very liable to be affected with the mildew, particularly some varieties.

In the fall of 1872 I selected several vine-leaves from the Department foreign grapery, having on their surface patches of mildew intermixed with perithecia of the *Erysiphe Tuckeri*. Having removed portions of them, I placed them on glass slides, and secured them in position with gum-water, over which I placed a thin glass disk. While viewing them under a power of about 100 diameters, I applied pressure on the disk in order to burst the perithecia. I used great care in my manipulation, but failed to get sporangia out of them. I then laid the leaves aside until November, 1874. In consideration of recent successful experiments on perithecia of black-knot fungus, I resumed my experiments on those of the foreign grape-vine mentioned. I removed a small portion of the leaves procured in 1872, containing the perithecia, placed one of them in a capsule, and poured over it concentrated ammonia, with the view of softening its albuminoid matter. To another portion I added nitro-muriatic acid and neutralized the acid by ammonia. This latter method has the advantage of bleaching the perithecia, which is naturally opaque, but when partially bleached are of a translucent Vandyke-brown color. Under either treatment the perithecia become soft and pliable, and the proper degree of pressure may be given during the operation while viewing them under



Oidium spores of the foreign grape-vine.

the microscope. In this way I have succeeded in bursting them and forcing out their sporangia in perfect form. I had previously failed in this experiment, probably for the reason that the sporangia had not matured sufficiently, and in consequence of the thinness of their cell-walls they burst with slight pressure, and a grumous mass was all that I obtained. The sporangia of perithecia of *Microsphæria* are easily removed, and seem to bear more pressure without breaking the cell-walls of the sporangia than those of the vine, judging from my experience thus far.

During the last four years I have examined many hundreds of specimens of the Oidium form of the vine fungus, but in no case have I seen connected with them pycnidia, a fungus described and illustrated by Professor Amicé and Doctor Plomley, of Europe, and represented by them as connected in some way with the *Oidium*. I am certain, however, that I have found in great profusion, during the summer and fall of both 1871 and 1872, on the vines in our foreign grapery, the true fruit or perithecia of *Erysiphe Tuckeri*. The Rev. M. J. Berkley says:

It is true that the real sporangia of the vine-mildew have not yet been observed. * * * We do not doubt, therefore, that at some future period the true sporangia may be found, and we trust that the little parasite which has been of such unlooked-for importance may still preserve the specific name originally assigned to it, in honor of the meritorious cultivator who first observed it. * * * It may, therefore, be named *Erysiphe Tuckeri*, and the name of *Oidium Tuckeri* should be rejected.

When Professor Planchon visited this Department last year, I prepared for him a microscope-slide containing specimens of the perithecia of *Erysiphe Tuckeri*, taken from a foreign vine of the Department grapery.

Should the climatic condition of the summer and fall of 1875 prove favorable for further investigation in this direction, I may be enabled to define more clearly the habits of *Erysiphe Tuckeri*, on a knowledge of which depends the proper remedy to be applied for its destruction and the consequent protection of the vine.

The following extract from a lecture lately delivered in the Royal Agricultural College, England, by Prof. W. R. McNab, I think will be of interest to all who desire to enter on the study of cryptogamic botany:

The study of the lower orders of plants is attended with many and great difficulties. This is owing chiefly to the minute size of the objects themselves, requiring as they do the microscope for their investigation. Then, again, most of our botanical text-books give only the most superficial description of the lower groups, and fix the whole time and attention of the student on the higher or flowering plants. The consequence of this is that the study of the higher plants is carried to such a length in our lectures on botany that little or no time is given to the lower orders, a plan of procedure as philosophical as that of teaching zoölogy merely from the vertebrates and omitting all other divisions. In the course of lectures on botany delivered in the Royal Agricultural College, I attempted to follow a more philosophic plan, and devoted some time to the consideration of the lower plants. Certain forms, whose life-history had been ascertained, were selected, and not possessing parts comparable to the stems and leaves of the higher plants.

To the more or less flattened or rounded cellular expansion of these plants, which may consist of only one or of thousands of cells, the term thallus has been applied; and the three groups possessing this may be united, to form a large division of the vegetable kingdom, called the *Thallophytes*. The thallus may consist of one cell or of many cells; these may be either similar or dissimilar. In some of these *Thallophytes* we have plants consisting of one cell, which performs the functions of nutrition during the day and those of reproduction during the night. In others we have one part of the plant set aside to perform the function of nutrition, while another part performs the function of multiplication only. In most of the sea-weeds the part of the thallus set apart for the purposes of nutrition is large, while the reproductive organs occupy only a small portion. In the funguses we have plants which obtain most of the nutriment ready made, and, as a consequence, an elaborate nutrient system is not required. Hence that portion of the thallus in funguses set aside for the purposes of nutrition, called the mycelium or spawn, is comparatively small, while the organs for performing the functions of reproduction predominate. The same law holds in the ani-

mal kingdom, as in many parasites we have a low type of the nutritive system and a largely-developed reproductive system.

In most of the *Thallophytes* we have two modes of reproduction, one a true sexual process, in which we have parts equivalent to the stamens and pistils of the higher plants, while the other is asexual, and therefore to be considered as a process of budding. These two modes of reproduction either alternate or else we may have budding taking place two or more times in succession before sexual reproduction again occurs. This fact is of the greatest importance, and must not be lost sight of.

In many of the sea-weeds we have this alternation of sexual generation with budding. At one period in the life-history of the plant true sexual organs may be produced, while at the other periods we have numerous small cells given off, each armed with two or more hair-like appendages. As these appendages are capable of moving, they propel the whole mass, to which, on account of its peculiar animal-like motions, the term zoöspore has been applied. The zoöspore may therefore be considered as a movable bud of the simplest possible construction. The same alternation of sexual generation with budding is to be met with in the funguses, and the *Peronospora* affords a very good example of it.

Many of our readers must have observed dead flies floating in water in the autumn, with their bodies all covered with fine hair-like threads. This appearance is produced by a plant, which was formerly believed to be a sea-weed, but is now placed among the funguses. If we examine the thread with the microscope, we observe a cellular mycelium or nutritive portion of the thallus. At the end of some of the portions of the mycelium we may probably observe a single large cell, the contents of which become broken up into small portions. These small portions of the protoplasm become liberated, and are zoöspores or rounded masses of protoplasm, with two hair-like appendages. When free, they are capable of moving about for some time, and then growth takes place, and each one will form a new plant; but in another we may observe that the ends of the branches of mycelium form a club-shaped cell. This club-shaped body is the female reproductive organ, and is called by botanists oögonium. At each side of this club-shaped body two smaller bodies can be seen, which spring from the same portion of mycelium as the oögonium, but below it; they are two small branches, which grow upward till they come in contact with the oögonium, being, in fact, the male reproductive organs, called by botanists antheridia.

Inside the oögonium are the granular contents, or portoplasm, forming the oösphere. This oösphere is fertilized by the contents of the small male branches, one or more oöspores being in this way produced. The oöspores are in fact comparable with the fertilized seed of the higher plants. After a period of rest the oöspore germinates, and produces a new plant. The reproductive process in the fungus resembles that of many sea-weeds which form oögonia and oöspores, the oöspores being formed after fertilization from the contents of the oögonium. Then, in the production of the moving buds, the zoöspores, which multiply the plant asexually, these funguses closely approach the sea-weeds. The passage from *Achyla* (the fungus possesses the sea-weed-like character just described) to the fungus producing the potato-disease is but a single step. In *Peronospora infestans* we have a thallus with the nutritive portion of it, the mycelium, ramifying through the potato-plant. It has also two modes of reproduction, sexual and asexual. In the asexual form we have a branching tree-like form of the mycelium, making its way through the stomata or breathing pores of the leaf.

This branching portion bears rounded swellings, arranged in a somewhat beaded manner, and called conidia. They do not produce zoöspores, but develop a mycelium distinctly. This is apparently figured in the Gardener's Chronicle, November 4, 1871, p. 1420, Fig. 3, as occurring in *Peronospora infestans*. Other observers, however, assert that the conidia never produce a mycelium directly, but always from several, in general ten, zoöspores. The zoöspores, after moving freely about, attach themselves to the cuticle of the plant, and surround themselves by a delicate wall; they then bore through the outer wall of the epidermic cell, and form a mycelium ramifying through the intercellular spaces of the potato-plant. If the young mycelium is formed in the tuber or potato, it may remain dormant during the winter, and then spread through the young plant as it grows.

The sexual organs of *Peronospora* develop inside the tissues of the host plant. The extremities of certain of the threads of mycelium form rounded bodies—the oögonia Inside the oögonia a portion of the protoplasmic contents forms the oösphere. On another branch of mycelium the antheridium is produced, which adheres to the wall of the oögonium, the contents passing into the oösphere, which is thus fertilized and the oöspore formed. The oöspore is surrounded by a thickened skin, which is rough and dark brown in color. After a period of rest, the fertilized oöspore germinates, and produces mycelium. The *Artotrogus* figured in the Gardener's Chronicle, 1871, p. 1420, (*a*,) is probably the oögonium, with the oöspores.

The fungus producing the potato-disease is thus interesting botanically from its peculiar relations to certain of the sea-weeds, in its mode of sexual reproduction, and in the production of moving zoöspores. From the effect of rain or dew in liberating these zoöspores it is not difficult to understand how the disease spreads rapidly in damp weather.

TESTS OF DEPARTMENT SEEDS.

The reported experiments with the Fultz wheat continue to be as favorable as heretofore; no falling off in average yields nor any deterioration have been reported. The success which has attended the distribution of this wheat is something unusual. The large produce per acre, and the adaptation of the wheat to diverse soils and latitudes, have created a demand for it among farmers which the Department cannot be expected to supply. It was said in the Annual Report of the Department for 1872 that in the selection of this wheat it was especially intended to add an impulse to wheat-culture in the Southern States, by furnishing an early, hardy, prolific, and reliable kind, calculated to inspire confidence and stimulate endeavor. That the Department was not mistaken is sufficiently clear from the reports heretofore published and from those of which notice will presently be made.

In Saratoga County, New York, one grain of Fultz wheat threw out nine stalks, bearing 378 kernels; selected heads in the field contained 50, 53, 58, and up to 63 kernels. Two quarts, sown about four weeks later than the planting season in Suffolk County, produced 40 quarts on a plot 15 by 90 feet.

One bushel, sown on an acre of ground, in Delaware, yielded 36½ bushels.

A farmer of Prince George's County, Maryland, sowed, in 1871, two quarts, on land which was naturally moist, too much so for the grain; two crops of Irish potatoes had been raised on the land in the two preceding years; horses and cattle ran upon it during the winter. The wheat sown produced 3½ bushels of fine grain, or fifty-six fold. This product was again seeded, and yielded 32 bushels, the quality not having deteriorated. It is considered a hardy variety. The Frederick County Examiner records a yield in that county of 42 bushels per acre on 42¼ acres; "a result which, as far as we have heard, has nowhere been equaled."

Mr. John A. Parker, of Tappahannock, Virginia, says he finds that sowing one-half bushel of this wheat to the acre is amply sufficient. It branches better than any other kind he has yet seen, and at the time of writing (January 18) shows much better than any fields of other kinds on which one and a half bushels per acre were sown. "The little parcel sent by the Department three years ago has caused a revolution in wheat-raising here." In Prince William County two quarts yielded 57, or, according to the amount of ground employed, within a fraction of 30 bushels per acre. Tappahannock, under the same treatment, gave less than 19 bushels per acre, sown on gray forest land. In Wythe County, four quarts, sown September 15, 1873, yielded sixty quarts of clean wheat. This product was planted September 9, 1874. On account of hardiness, this wheat is considered as filling a great want felt in that high locality. Lancaster wheat yielded at the rate of six quarts to one, and Tappahannock ten for one. In Dinwiddie County one bushel and a peck, sown on an acre of gray, stiff soil, in October, yielded 19 bushels, superior in growth, yield, and weight per bushel to other varieties grown in the vicinity. The following interesting statement, which comes from Halifax County, is given entire:

The land, which had been in tobacco, was plowed with single-horse plow on the 16th of October, a warm, sunny day, the ground warm and dry. It was then harrowed. On the 17th the wheat was rolled in Pacific guano, flour of raw bone, and plaster, mixed, a third

of each. The peck of Fultz was sown upon one-fourth of an acre of good land, or at the rate of one bushel per acre. The mixture above described was then applied at the rate of 250 pounds per acre, being about 63 pounds put upon the peck of wheat, besides the fertilizer used in rolling it. The wheat was then *well* dragged. The weather was fine for the purpose, and it remained warm and clear for some time after the wheat was sown. The wheat shortly made its appearance, looking very thin. It continued to look so, although having a healthy and green appearance until about the middle of March, up to which time there had been pretty severe weather and cattle and hogs were most of the time on the wheat. On the 21st of April I sowed ashes, guano, and plaster broadcast on the wheat. By the 1st of May the growth had improved very much, and on the 23d of May it presented a really beautiful appearance, the difference between it and another variety, known as the "little red" here, being plainly visible. The Fultz had a broader blade and a larger and fuller head. It was, however, occasionally spotted by a bearded wheat, which was mixed with it and which appeared to be even a better kind than the Fultz. It was ripe on the 22d of June. The peck sown yielded eight bushels and a half, or at the rate of 34 bushels from 1. The grain was large and plump, and the straw bright, standing up well.

A correspondent of Orange County, North Carolina, says that Fultz wheat has yielded more per acre than any other wheat ever cultivated in that locality. The highest yield of this wheat, up to this time, has been 35½ bushels from one sown. A useful lesson to farmers may be drawn from the following extract from the letter of this correspondent —the lesson of interchange of seeds among farmers for the advancement of mutual interests:

The Fultz-wheat fever among the farmers was very high while the limited supply lasted. None was to be had except the product of seed originally sent by the Department. Double price and two bushels for one of Fultz were offered, but the agricultural club to which seeds had been sent did not feel at liberty to speculate on them. Therefore bushel for bushel, in small quantities, was exchanged to reliable farmers, who we felt confident would do the best with it. In Henderson County the Fultz yielded twice as much as other varieties.

A correspondent writing from Lauderdale County, Alabama, gives the following as his experience with one quart of this wheat received from the Department in 1872:

This is my third crop from the one quart of wheat received. The amount of land employed was four and one-half acres, from which I have just thrashed ninety bushels of splendid wheat, or twenty bushels to the acre. It was sown in a field by the side of eleven acres of reed-straw wheat, which yielded nine bushels to the acre. The season was very unfavorable on account of heavy and continued rains throughout March and April. About the 1st of May the Fultz was badly scalded, or blighted; in fact, looked as if it would not make half a crop. With a favorable season, I am confident it would have made thirty or more bushels per acre. I think it will prove the best wheat yet introduced into this part of the South. Our average yield of wheat for the last five years has been about ten bushels.

Very favorable reports have been received from Texas.

Reports from several counties in Tennessee, in addition to those of last year, continue to approve this wheat as a most valuable acquisition. In Smith County it is considered equal in quantity and quality of yield to the best varieties grown in the locality. A farmer of Campbell County reports that he sowed one gallon broadcast in 1871, and reaped 4¼ bushels of beautiful wheat. The next year, he sowed one acre and reaped 32½ bushels—the best wheat in the neighborhood. In 1873, sowed 20 bushels, which, at the time of writing, presented a fine appearance. Four quarts were sown in McNairy County on one-eighth of an acre, dry upland soil, nearly worn out, but slightly fertilized with cotton-seed; yield, 22 gallons, and about two gallons wasted in cutting and thrashing. A Coffee County correspondent says, concerning six quarts of Fultz received from the Department in 1871, that he handed five to a neighbor, who reaped a product of 8 bushels; the next season's product from the 8 bushels was 24 bushels per acre, an average of 5 bushels over his other varieties. In 1874 his average was 25 bushels per acre, a gain of 5 bushels per acre over other varieties. Another farmer in the same county sowed 2 bushels on 3½ acres, which he had prepared

to sow with timothy. He harvested 94 bushels of wheat from the amount sown. A farmer of Bradley County makes the following statement:

I sowed eleven varieties, and all but three rusted. Fultz, Arnold's Canada hybrid, and Burke's golden-straw did not rust, because they ripened from nine to fourteen days earlier than our common wheats. Burke's golden-straw was fourteen days earlier and weighed seventy pounds to the bushel. It makes as much flour from 4.72 bushels as can be made from five bushels of any other variety. The Fultz yields more than any other. From one quart sown last year, and the proceeds resown this year, I have received 83 bushels by weight. It produced on my farm 30 measured bushels per acre, weighing 64 pounds per bushel.

A correspondent of Sullivan County says:

The Fultz wheat gives a larger yield per acre than any other variety grown in this section. At the August meeting of the Watauga Farmers' Club a premium was offered for the best half acre of wheat harvested in 1874, each competitor to use his own judgment in selecting his plat of ground, kind of manure, seeds, &c. I experimented on a high, dry, gravelly soil, with stiff clay subsoil; plowed the land in August 5 inches deep, and let it lie until the 10th of October; then harrowed, and spread eight two-horse loads of chip-manure from my wood-pile. I then spread 150 bushels of slacked lime on the manure, and replowed the ground; sowed broadcast 45 pounds of Fultz wheat, October 21, harrowing three times. The wheat came up very soon, looking strong and sturdy; harvested June 12. Product 1,264 pounds, or 21 bushels and 4 pounds on the half-acre lot. This piece of land never before yielded more than 8 bushels per acre without manure, and in this case I attribute my success to the lime and superior seed.

In Hardin County, Kentucky, one quart of Fultz produced 2 bushels, which, sown the next season, yielded 83 bushels of excellent wheat.

In Vinton County, Ohio, this wheat was very successful. Eight bushels yielded 189 bushels, weighing 64 pounds per bushel, struck measure. This is the result of two quarts received three years ago from the Department. In Delaware County Fultz realizes all that has been claimed for it. Adams County: Six quarts, sown three years ago, produced 1¼ bushels, which, sown the following season, yielded 21 bushels; and this product, planted on oat-stubble well prepared, the thinner portions top-dressed with stable-manure, yielded (1874) 425 bushels, weighing 63 pounds per measured bushel. Number of acres employed, 12. A farmer of Knox County writes:

In the fall of 1872 I sowed one pint of Fultz wheat on hilly ground; it produced one bushel. That bushel I sowed in the autumn of 1873, and it produced 33 bushels of excellent wheat of plump, solid kernel, color of a yellowish cast. It stands the winter better than any other wheat, and produces a heavy straw, such as is necessary for a hilly country. I sowed the Fultz side by side with Lancaster, and the former will yield from 10 to 12 bushels more per acre than the latter.

A yield of 50 bushels from 4 sown is reported from Saint Joseph County, Michigan, weight 63 pounds per bushel.

In Scott County, Indiana, continued success is reported. A farmer reports that, after growing the wheat three seasons, he is satisfied it will yield from one-fourth to one-third more than any other variety cultivated in the county. Two years ago another farmer in this county harvested 180 pounds from four quarts; having planted this product, he raised 80 bushels on two and a half acres. After two years' experiment a correspondent of Delaware County says, "it is the most promising variety tested here since the introduction of Red Mediterranean. This season it yielded 30 bushels per acre, was about six days earlier than any other variety, the grain remarkably plump, and weighed 63 pounds per measured bushel. It readily sold for 25 cents per bushel more than any other kind of wheat." Hon. W. E. Niblack inclosed to the Department the statement of a farmer in his district, from which it appears that a sowing of one quart of Fultz, November 6, 1871, yielded 30 pounds. This

product was sown in September, 1872, and yielded 10 bushels. In turn, this was sown in September, 1873, and produced 300 bushels. Two acres, sown after tobacco, yielded 104 bushels. The entire crop was grown on clay soil.

In Benton County, Minnesota, this wheat yielded at the rate of 42 bushels to the acre.

The results for three years on the experimental farm of the University of Wisconsin are given as follows:

Sown.	Rate per acre.	Harvested.	Yield.
September 18, 1871	1¼ bushels	July 12	33 bushels.
September 10, 1872	1½ bushels	July 11	20 bushels.
September 5, 1873	1¾ bushels	July 1	34 bushels, 55 pounds.

The yield in each case is given by weight, 60 pounds to the bushel; the grain has weighed from 60 to 62 pounds per measured bushel. The crop of 1872–'73 was on new and partly low ground. The ice in early spring killed a part of the crop. This year, 1874, a lot on old ground, following oats, and on a side hill facing south, yielded 29 bushels and 26¼ pounds per acre.

Reports from six counties in Missouri are all of the most favorable character, indicating that the Fultz wheat is beginning to be ranked above the Tappahannock, so popular as a variety in that State.

From distant Oregon come similar reports concerning the adaptiveness of this wheat. In Coos County the yield was at the rate of 34 bushels per acre. A correspondent of Wasco County says: "It is a decided acquisition, producing at the rate of 40 bushels per acre; the grain is of extra quality, sown on prairie, without fertilizers or irrigation."

ARNOLD'S HYBRID, No. 9.—A Canadian variety, the history of which was given in the annual report of the Department for 1873. The first distribution of it was made in time for the fall sowing of 1872. Experiments were reported and published by the Department in 1873, which indicated good results in Virginia, New York, Pennsylvania, Illinois, and Ohio, and failures or doubtful results in Nebraska, Iowa, Wisconsin, and some parts of Indiana. Some of the more important of the experiments in the year 1874 are here referred to. *New York*, Chautauqua County: The yield was bountiful and of excellent quality. Oneida County: Seven quarts yielded 225 pounds. At the same ratio per acre the yield would be 30¾ bushels. It ripened about the same time as Mediterranean. *Virginia:* A correspondent of Rockingham County says concerning his experiments with Arnold's Hybrid and Tappahannock, that "the first did tolerably well considering the drought in the spring; from one-half gallon I raised a peck; Tappahannock did not do at all; I got no seed from it; it looked well in the fall and early spring, but the ravages of the fly and hard frost in March destroyed it totally." *Ohio*, Hamilton County: In 1873, one quart yielded 32, and this, in 1874, 15 bushels. Holmes County: The secretary of the County Agricultural Society says: "Two quarts of this wheat were sown in the latter part of September on potato stubble. The land was fresh, having produced but two crops since having been cleared. It was a rich, calcareous loam, the land sloping a little to the east. The plowing was done with the common two-horse plow, the whole sown broadcast and covered with the harrow. Fertilizers of no kind were used. From these 2 quarts I harvested 5½ bushels of clean wheat, or 88 fold. It is a smooth wheat,

straw stiff, growing 5¼ feet high, and ripening six or eight days behind the Mediterranean. The berry is long and of a dark red color, somewhat resembling the Mediterranean, when first introduced. On the 30th of August last, I sowed four acres of land with this wheat, keeping one-half bushel for exhibition at the county fair." *Indiana*, Dearborn County: A failure, injured by rust and midge. *Wisconsin*, Pierce County: About 6 pounds sown September 5, on rich loam, was cut August 1, yielding 3 bushels of very fine wheat having a large berry and weighing heavy. Stood the winter well. *Minnesota*, Nicollet County: Did not do well; A failure, also, in Louisa County, Iowa. A favorable report comes from Oregon, but the Tappahannock is considered the better wheat of the two.

JENNINGS WHEAT.—This variety originated in central Pennsylvania, and, on account of its superior excellence, a quantity was purchased and distributed by the Department in 1873. Only a few reports have been received concerning it. From these it is evident that this wheat will prove an acquisition at the South. A correspondent writing from Delaware makes the following comparison: Jennings, sown September 10; cut July 1; product, at the rate of 36 bushels per acre, weighing 62 pounds per bushel. Fultz, sown September 10; cut July 1; product at the rate of 32 bushels per acre, weighing 60½ pounds per bushel. Mediterranean, sown September 10; product at the rate of 24 bushels per acre, weighing 58 pounds per bushel. All sown on a well-fertilized hillside of light clay soil with southeast inclination. The Jennings and Fultz stood well; the Mediterranean lodged early. The Jennings stooled abundantly. The quality of the wheat was superior; skin thin; grain plump, and flour white and rich.

Dr. H. M. Price, of Fluvanna County, Virginia, reports the results of a comparison between the Jennings and two other varieties. He sowed the Jennings October 9, on one-twelfth of an acre, which before had been planted in cabbage. Soil, a dry, stiff clay, which was fallowed and harrowed, and the seed turned under with a shovel-plow. No fertilizer used. On the same amount of land equal quantities of the Clawson and Tappahannock, respectively, were sown. The following is a tabulated statement of results:

	Weight of straw.	Weight of grain.	Yield per acre.	When ripe.
	Pounds.	*Pounds.*	*Bushels.*	
Jennings	485	165	33	June 16.
Clawson	461	183	36 3-5	June 20.
Tappahannock	401	122	24 2-5	June 14.

In Dorchester County, Maryland, one gallon of this wheat seeded on one-fourth of an acre of fallow land, October 5, produced 7½ bushels of perfectly clean wheat, which weighed 58 pounds to the bushel. It ripened about the 25th of June. The intense heat of the season prevented it filling as well as under more favorable circumstances. It is regarded by the correspondent as a first-class white wheat, well adapted to the climate.

A farmer of Garrard County, Kentucky, says that 4 quarts produced 96 pounds of clean wheat; "it is fine and plump, stood the winter well, branches finely, and the straw is very strong and not liable to fall; heads long and full." A Monroe County, West Virginia, correspondent sowed 4 quarts in September, and the yield was 3½ bushels by measurement, or an increase of 29 to 1. The land was a clay limestone having a southeastern exposure; no manure or fertilizer of any kind was used.

OATS.

The new varieties of oats introduced by the Department have given satisfaction. The Hopetown are very favorably reported upon from Tennessee. A correspondent writing from Maury County says: "The Hopetown seemed to me to be more vigorous, with larger stem, than other varieties. I am satisfied that the variety will do well in this county." In Smith County 1¼ bushels, sown March 20, yielded at the rate of 30 bushels per acre, weighing 33 pounds per measured bushel; the yield in both quantity and quality pronounced equal to the best varieties. In Kansas the yield was large; heads heavy and strong; straw stout, with abundance of fodder attached. In Polk County, Oregon, this variety is highly prized. A half gallon was sown about the 15th of April; product, harvested July 20, 4½ bushels, weighing 42 pounds per bushel. "They are of a very quick, strong growth, and stand up well until they are ready to harvest." In Santa Fé County, New Mexico, this variety seems to be preferred to the White Schönen.

The Potato oats, distributed for the first time last year, have been measurably successful. An account of this variety was given in the annual report for 1873. The success of the variety was quite marked in York County, Maine. In New London County, Connecticut, 4 quarts produced 2¼ bushels of very superior oats, weighing 43¼ pounds per bushel. Reports from three counties of New York have been received: Erie, a failure—no particulars as to culture; Wyoming, two weeks later than other varieties; Steuben, on alluvial soil, matured a week earlier than the Probstier; on clay soil ripened ten days later than common oats, but was heavier; on gravelly soil compared favorably with other varieties. The Schönen oats were planted on yellow loam and grew nearly 5 feet high; straw large and stood well, but ripened late, the berry being much lighter than that of the common variety. The reports from Pennsylvania are not uniform as to the success of this variety; while an account from York County refers to the oats as later than common varieties, although treated in like manner, a statement comes from Northumberland that this variety is very successful; "the straw as long as rye and the yield of grain unusually large." Very favorable accounts have been received concerning experiments made in Columbia County. A correspondent in Campbell County, Virginia, states: "I cannot say too much in praise of the Potato oats. Two quarts yielded 2½ bushels of the finest grain I ever saw, notwithstanding a very unpropitious season." *North Carolina*, Orange: "Heads light and chaffy; do not seem to be adapted to this climate and soil." *South Carolina*, Clarendon: Planted in March, the ground having been well prepared; came up well, but were at least twelve days later in maturing than the common varieties; yield good. *Tennessee*, Macon: Yield good in quantity but poor in quality, and later than other oats sown at the same time. *Texas*, Fort Bend: "The Potato oats sent me last spring were sown on light, sandy land; harvested the last week in June; yield heavy; no sign of rust or other defect." From Mahoning, Ohio, a report of an experiment favorable to these oats has been received. A farmer in Grundy County, Illinois, gives an account of a favorable yield, the stalks growing from 6 to 8 inches taller than the Norway oats sown the same day. *Wisconsin*, Dodge: From five to ten days later than the common oats, but the yield good and quality superior. In Minnesota this variety seems to have failed by reason of rust.

In Phelps, Missouri, the Potato oats did not equal the Excelsior, planted on the same soil. A Boone County correspondent says:

The Potato oats were planted in fine soil, with much care, in one corner of a fifty-acre field of Black oats, a space being left between the two varieties to prevent mixture. The season was unfavorable for oats, yet there was a medium crop of both varieties; the Black, however, were much the better. When the field was harvested, ten acres of the Black, next to and together with the Potato, were left standing for one hundred head of Berkshire hogs. I left the Potato oats because I did not think them as good as the Black, which I have raised for many years with great success. The hogs consumed the whole ten acres of Black oats before touching the Potato.

An importation of Fellow oats was made from Scotland, and first distributed in time for the planting-season of 1873. The distribution was continued during the present year, with results as below.

Maine, Knox: The early Fellow and White Schönen oats yielded about equally—about a bushel from one quart of seed. They appeared to grow more vigorously than the commonly known varieties, attaining a greater height by about 10 inches; no tendency to lodge; heads heavy and kernels well filled; very much superior to the ordinary varieties. *Vermont*, Addison: Yield about 40 bushels per acre. A favorable report also from Washington County. *Connecticut*, New Haven: Sown on heavy, gravelly soil, yielded better than other varieties grown alongside them; on sandy soil, 3 quarts returned $3\frac{1}{3}\frac{1}{2}$ bushels, weighing 36 pounds per bushel. Very successful in Wyoming, Pennsylvania. *Delaware*, New Castle: Yielded at the rate of 48 bushels per acre, while the Delaware oats yielded 37 on the same soil. The season was not favorable for the growth of oats. *Maryland*, Cecil: Grew taller, yielded better, and weighed heavier than common varieties. Washington: A valuable variety. As many as twelve heads from a single grain were noticed. *Ohio*, Darke: A correspondent says this variety was sown thinly on a small patch of clay land; came up well and grew finely; tillered very finely; blades larger than those of common oats; straw strong, standing up well when common oats had fallen by reason of winds; ripened in August, one week later than common varieties sown at the same time. Ottawa: Sown in April, and grew to a height of 3 feet; are hardly as early as Black oats. Accounts from three counties in Illinois give favorable results; in Hancock, earlier and better than any other variety, as reported by one correspondent; White Schönen, sown on black loam, yielded about 60 bushels per acre. *Michigan*, Hillsdale: Four quarts sown on sandy, gravelly soil, ripened early; yield, 15 bushels of excellent quality. *Wisconsin*, Waupaca: Regarded as superior to White Schönen; 2 quarts sown on one-eighth of an acre produced 3 bushels of fine oats, or at the rate of 54 bushels per acre, sandy soil, without extra cultivation. Door: Sown April 21, harvested September 1; straw short and coarse; grain handsome; yield not above the average. Potato oats sown and harvested on the same dates as above; straw medium in height; grain plump and handsome; average yield a little better than common oats. The Schönen oats averaged over $5\frac{1}{2}$ feet in height; grain of best quality; yield, forty-eight-fold. *Iowa*, Floyd: "Splendid oats; 4 quarts, sown April 15 on prairie-sod, yielded more than 2 bushels." Another report from same county gives the weight of this grain per bushel at $42\frac{1}{2}$ pounds. *Missouri*, Bollinger: Fellow, Schönen, and Somerset sown at the same time, and the first-named considered the hardiest. Yield in Nemaha County, Kansas, thirty-fold.

Experiments made with Somerset oats, a variety imported from England, have been very favorably reported from Maryland, Missouri, Iowa, and Kansas; they seem, however, not to have succeeded so well in Alabama and Texas.

RUNNER'S WHITE CORN.

On account of the high reputation of this corn in Missouri, where it has been cultivated for some years, the Department determined on a trial of it in other parts of the country to which it seemed adapted. A farmer of Benton, Missouri, says:

I have raised this corn about five years, having first obtained a few kernels of it from Warren County, Kentucky, where it was noted for its superiority. I have had extraordinary success, and so also have others in this section of Missouri. The demand for seed far exceeds the supply. I have found it more satisfactory than other kinds. It is of a purer white, yields more per acre, and makes better bread. I raise two and three stalks in the hill, but it rarely yields more than one ear to the stalk. I have raised on an average 85 bushels per acre. It produces well on prairie, and on rich bottom-land yields enormously. Am of the opinion that one ear of this corn is heavier than two of most other kinds.

Another gentleman of the same county, who has been cultivating corn for fifty-one years, and has raised three successive crops of the Runner, says: "It is freer from impurities of every kind than any corn I have raised. The ears are heavier than two of other kinds. It generally produces one ear to the stalk, and from two to four stalks in a hill. In yield it far excels any other kind." Other farmers in the same vicinity corroborate these statements. Mr. James B. Colgrove, a practical miller, of Lincoln, in the same State, from whom a supply of this corn was purchased by the Department, says:

Of its production, yield, and remarkable purity you know. There is only one verdict among reliable planters. True, there are some who condemn. Of this class you can judge. They come to mill with old ragged sacks, with cobs and hay stuck in the holes, shiftless characters, who plow shallow and cultivate poorly, then condemn the variety which does not yield a large return. Probably fifty well-to-do, thrifty farmers have assured me during the fall (1873) that they never saw as good corn, as good yields, nor any that stood the drought as well.

This gentleman, who has devoted much attention to corn-cultivation, says also, concerning this variety, that there are certain isothermal lines beyond which, even for experimental purposes, it would hardly be worth while to expect favorable results. He thinks that a line across the continent dividing the State of Maryland on about the thirty-ninth parallel; thence southwest, so as to cut out the mountains of West Virginia; thence through Southern Ohio, and striking the eastern boundary of Indiana on the fortieth parallel; thence to the northern boundary of Missouri; thence west and embracing nearly or quite all of Kansas, would be a safe division of the country best adapted to its cultivation. In most of the Southern States, and especially where the soil, in addition to its fertility, is a sandy loam, he would look for satisfactory results.

The Department distribution in time for the planting-season of 1874 was not large, and the reported experiments have been few. The tests of next year will undoubtedly be more numerous as well as more satisfactory, and will, perhaps, go far toward settling the question of adaptability in many of the States. One thing, however, is very evident, that the results attained in Missouri may only be equaled by the most careful cultivation. And when experimenters report, it is to be hoped that they will not fail to be particular in giving the details of cultivation. A mere statement that a variety succeeded or failed is really worthless. The questions are: What were the conditions of planting and growth? and what methods of cultivation resulted in success or failure? Some of the experiments reported from the first distribution are here given:

Alabama, Dallas: Planted on sandy loam, does well, but not considered suitable for a field-crop. *Florida*, Suwanee: Fully three weeks

earlier than common corn; excellent, and produces well. Madison: Sown late in spring, on land planted in rye for pasture; had two plowings. Planted common corn at same time on same land. Runner's had small stalk, but heavy ear, so heavy that the corn fell badly. The common had not "silked" while the former was in roasting-ear, but the common had fine large stalk with fine ears. Runner's would answer well for an early crop for meal-corn, and to supply fresh corn to stock instead of the old. *Louisiana*, East Baton Rouge: Has yielded immensely; ears large and very fine. *Texas*, Kendall: Three experiments are very flattering to this variety, especially with regard to its early ripening. Williamson: Three weeks earlier than the common corn, and only one week behind Stowell's Evergreen. The following report of experiments with two varieties of corn is made by a correspondent of Bexar County:

Kind of seed.	Quality of soil.	Time of rain-fall.	Time of frost.	Manner and time of cultivation.	When planted.	When ripe.	Yield per acre.
Yellow field-corn.	Black bottom-land.	May 10, 12, 28, 29, 30, 31, light; June 16, heavy; June 23, 24, light; July 2, heavy; 3, light; 11, medium; 16, 19, light.	Apr. 10, 11	April 30 and May 23, with one-horse plow.	Mar. 31	Aug. 1	26 bushels.
	Gray sandy surface, yellow clay subsoil.	....	Apr. 10, 11	April 25, with sweep; May 18, with plow and oxen.	Apr. 2	Aug. 1	34 bushels.
Runner's white	Black sandy...	....	Apr. 10, 11	May 9, with two-horse plow.	Mar. 30	July 20	About 25 bushels.
	Black bottom-land.	....	Apr. 10, 11	April 30 and May 23, with one-horse plow.	Mar. 31	Aug. 12	16 bushels.
	Gray sandy surface, yellow clay subsoil.	....	Apr. 10, 11	April 25, with sweep; May 18, with plow and oxen.	Apr. 2	Aug. 20	20 bushels.

A correspondent in Bledsoe County, Tennessee, planted yellow field-corn and Runner's at the same time. The former yielded well, and ripened in three and a half months. He states that the latter ripened about three weeks later, and adds: "But is the best corn I ever saw, although planted on poor mountain land, which had never been manured, and had been in cultivation for thirty years." In Utah this corn made the finest growth of any during the season, withstanding the hot winds.

DOES FARMING IN NEW ENGLAND PAY?

This question has been much discussed in the Eastern States, and answered variously in accordance with the views of those canvassing it. It has been put to our correspondents, who have answered it almost unanimously in the affirmative, as to systematic and enterprising operations—otherwise the average success being moderate, yet sufficiently liberal for the half-hearted and feeble effort put forth. Before presenting the views of several progressive farmers, fortified by facts illustrating well the difficulties and the possibilities of New England agriculture, a few suggestive statistics will be presented.

The farm-lands of New England include 19,569,863 acres, of which 61 per cent. are improved, 31 in woodland, and 8 in unimproved or waste areas. The details are:

States.	Improved.		Unimproved.			
	Acres.	Percentage of total acreage.	Woodland acres.	Percentage of total acreage.	Other unimproved acres.	Percentage of total acreage.
Maine	2,917,793	49.9	2,294,740	38.1	695,525	11.9
New Hampshire	2,334,487	64.7	1,047,090	29.	224,417	6.2
Vermont	3,073,237	67.8	1,386,934	30.6	68,613	1.5
Massachusetts	1,736,221	63.5	706,714	25.8	287,348	10.5
Rhode Island	289,030	57.5	169,399	33.7	43,879	8.7
Connecticut	1,646,752	69.6	577,333	24.4	140,331	5.9
Total	11,997,540	61.3	6,112,210	31.2	1,460,113	7.4

Only seven States have a larger proportion of improved land—Illinois, 74.6 per cent.; New York, 70.4; Ohio, 66.6; Delaware, 66.3; New Jersey, 66.1; Maryland, 64.5; Pennsylvania, 63.9.

Lands are low in price, averaging $29.90 per acre; lower than in settled Western States, viz: Ohio, $48.56; Michigan, $39.74; Illinois, $35.56; Indiana, $35.03; much lower than in five other States, viz: New Jersey, $86.14; Pennsylvania, $57.98; New York, $57.35; Delaware, $44.39; Maryland, $37.75. With unexampled market facilities, this small capital in land would be cheap for a bed of sand as a matrix for the development of plants, by means of added fertilization. A total capital of $100 per acre, or $6 per acre rental per annum, would not indicate very high farming, and yet it would admit of adding $1,371,000,000 for stocking and improving New England farms to the $585,000,000, the present value of the farm-lands.

Though the tilled area is comparatively small, and the breadth in cereals still less, the rate of production in New England will bear comparison with that of any other section. The average annual yield of corn for the past ten years is greater than in the Western States; Vermont surpasses Ohio, and only two of the six States fall behind Illinois. In wheat a larger yield is obtained than in any of the other divisions of our country; and the same is true of potatoes and tobacco. Look on this picture of average yield for ten years:

	Corn.	Wheat.	Rye.	Oats.	Potatoes.
Maine, bushels	29.6	13.1	16.4	25.9	122
New Hampshire, bushels	34.9	15.	16.7	31.6	112
Vermont, bushels	36.7	17.	16.2	34.9	141
Massachusetts, bushels	34.2	16.8	16.3	29.4	111
Rhode Island, bushels	27.3	16.3	16.8	31.6	93
Connecticut, bushels	31.1	17.3	14.2	32.9	100

And on this:

New York, bushels	30.6	14.8	14.7	32.4	100
Pennsylvania, bushels	35.1	13.1	13.6	31.	91
Tennessee, bushels	22.5	7.6	9.5	17.5	71
Illinois, bushels	30.	11.9	16.	30.6	74
Iowa, bushels	35.	13.1	18.4	35.8	97
Kansas, bushels	33.8	15.4	20.	33.1	96

Now compare the prices of these products in December, 1874, in the same States, and note the advantage of New England in that regard:

	Corn.	Wheat.	Rye.	Oats.	Potatoes.
Maine	$1 13	$1 54	$1 19	$0 67	$0 54
New Hampshire	1 12	1 55	1 20	65	59
Vermont	1 10	1 43	1 06	57	43
Massachusetts	1 10	1 45	1 11	67	69
Rhode Island	1 18	....	1 16	73	82
Connecticut	1 17	1 45	1 21	72	72
New York	93	1 26	92	57	57
Pennsylvania	76	1 21	90	59	79
Tennessee	68	1 06	1 05	57	97
Illinois	56	86	71	45	83
Iowa	43	65	63	38	50
Missouri	74	83	69	47	85

These figures show a fair return for agricultural labor. Taking the whole number of persons in the United States engaged in agriculture in 1870, as reported by the census, and the aggregate return of value of the annual products of agricultural labor, it is found that the average is $413 to each man. Now very many of the agriculturists of New England work in winter at shoemaking and other mechanical labor, having only a very short summer for farming, and yet the average return per man is $490, $77 more than the general average, without counting the proceeds of other labor. Making such a calculation for all these States, the result would be as follows:

	Value of products.	No. of agriculturists.	Earnings per capita.
Maine	$33,470,044	82,011	$408
New Hampshire	22,473,547	46,573	482
Vermont	34 647,027	57,983	597
Massachusetts	32,192,378	72,810	442
Rhode Island	4,761,163	11,780	404
Connecticut	26,482,150	43,653	606
	154,026,309	314,810	490

The Middle States having good markets also, and a longer term of labor, exclusively agricultural, during the year, average $686; the States of the Ohio Basin, with a fertile soil, yielding only $498; and the Southern States average but $267. Need the eastern farmer despond?

After giving an interior view of the agricultural economy of this section, with the aid of original facts from reliable sources, a summary of practical conclusions will be presented.

FARMING IN NORTHERN NEW ENGLAND.

Maine.—Mr. H. G. O. Smith, a farmer in York County, states that he knows of cases of successful farming in that region, but acknowledges the existence of a listless and despondent spirit in agricultural circles. He thus illustrates the situation, and distinguishes between real and pseudo farmers:

Webster says a farmer is "one who cultivates a farm;" but usage includes others than cultivators. For example, we have grocery-farmers, who spend their time discussing better methods. Road-farmers sow their seed by the wayside, and the fowls devour it. Mixed farmers do a little skimming and much bragging in addition to their regular business. Fast

horse farmers run our agricultural societies, seed in October, landlords gathering the harvest. All these classes fail to make farming pay, and should be counted out.

Least known, but not least in numbers or importance, are working farmers. They furnish bread and meat, pay the taxes, and live comfortably, unless, like Issachar of old, they voluntarily crouch down between the social and political burdens of the day. Farming does not yield as much income as mechanical or mercantile pursuits, yet farmers, being more economical, lay up the most, seldom compromising with creditors. I suppose three-fourths of the regular farmers in York County to be substantially free from debt, while one-fourth, at least, have money at interest. I estimate the average income at 3 per cent. on the capital invested, and $20 per month for the man's labor, after deducting farm expenses. The remuneration is sufficient to support a family comfortably, provided they live from the farm instead of the store; but not sufficient to permit leisure or luxuries. Lack of these, the concentration of educational and religious privileges in the villages, fancied loss of social equality, heavy taxes, and, most of all, abandonment of the homestead by children, combine to weaken the courage of New England farmers.

Mr. Robie Whitney, of Sebago Lake, Cumberland County, gives as the opinion of a majority of the farmers of his county, that "farming is not a paying occupation at the present time." He says that it was undoubtedly remunerative during the war, when currency was inflated, produce in demand, and prices high, but now that prices have fallen, Government bonds exempted from taxation, and capital in railway and other securities secreted so extensively to evade taxation, the burden falls with crushing force upon the farmers; and the men of capital, energy, and skill, who should lead the van of enterprising cultivators, leave the ranks, hide their money, or invest it in other enterprises less heavily taxed or more remunerative. With faith in the capabilities of agriculture in Maine, and a recognition of certain advantages over the West, he still thinks the present time unfavorable for buying farms on credit and paying for them out of the profits of their culture. He supposes the purchase of a stocked farm by a young man at $3,000, with interest at 8 per cent., or $240, cost of clothing and other outside necessities, $365; annual depreciation of property $100; unjust taxes, $50; a total of $755 to pay annually before a dollar of the principal can be discharged. He thinks the prospect of clearing the farm a poor one, and desires the exemption of mortgaged farms from taxation. He gives the following example of the more prosperous class of farmers, Mr. Charles Johnson, of Gorham, whose work is done by himself and a son sixteen years of age:

My farm consists of about 115 acres of improved land, divided into about 55 acres of grass and tillage, and 60 of pasture. I cut about 55 tons of hay; keep 8 cows, using 2½ tons of hay each to winter them, 20 tons; one pair of oxen, 5 tons; two horses, kept the whole year, 6 tons; four young cattle, 4 tons; 12 sheep, 3 tons. Total 38 tons.

This leaves a surplus of 17 tons, worth, in the barn, $14 per ton	$238 00
3 acres sweet corn, 8,300 cans, at 4½ cents	373 50
Milk from eight cows	600 00
Profit on oxen	50 00
Growth of young cattle, estimated at	30 00
Profit of 12 sheep	84 00
100 bushels of potatoes	50 00
Total	1,425 50

The land on which I raised my corn was clay loam; one acre was ground newly-broken, on which I put about eight cords of barn-yard manure, and spread and worked it well with plow and harrow, also 400 pounds of phosphate to the acre. The other two acres were planted to potatoes the year before, manure applied in the fall, and plowed in very shoal; applied 400 pounds of phosphate to the acre. The expenses of meal for the stock, phosphate, carriages, harnesses, fencing material, repairs on buildings and all other incidental expenses, are to come out of the above amount. I did my work with my son, sixteen years old. This statement is for the year 1873.

Mr. W. H. Johnson, of East Corinth, Penobscot, says farming has always paid, if properly conducted, and will pay even if done in a shift-

less and half-hearted way, for such a farmer could not get a living in any other business. Half of the cultivators of his county do not farm well, for want of energy, skill, and a proper knowledge of tillage. He thinks the remuneration as certain as in any part of the country east of the Rocky Mountains. He cannot give an example in complete detail, as he does not know of a farmer who has kept an account of yearly expenditure and income.

Mr. O. W. True, of Farmington, Franklin, deems the results of agriculture as much dependent upon energy, skill, and the use of necessary capital, as any other business, and that with these requisites it brings prosperity. One of his neighbors said, as his testimony on the subject: "I have six farms. Everything is done by hire on them, and with as equal skill as I can command. One pays 10 per cent.; the other five 3 to 5 per cent.," showing, as he thought, that much depends upon the farm and its situation.

Mr. James W. Ambrose, of Sherman Mills, Aroostook, the very "jumping-off place" of the Sunrise State, and highest latitude of the eastern portion of the United States, affirms the signal success of farmers there who conduct their business with energy and system. He writes as follows:

The ill success of many so-called farmers of New England, owes its origin to a lack of careful study of the business engaged in, and consequent lack of intelligent or well-directed efforts. While many of us occupy the first rank of intelligence in state or national affairs, many of us need "posting up" in relation to our own business. We have in Maine about seventy thousand farmers and *one* agricultural paper, while we support at least twenty political papers, besides all the other literary publications of the State.

I will relate an example of successful farming which came under my own observation. A man, about thirty-five years of age, moved into this county fourteen years ago with eight in his family to provide for. His capital consisted of about $33 in cash and an old horse worth about $25. He purchased wild land of the State at 50 cents per acre, payable in labor on the highway. He felled his trees, piled his logs by hand (having exchanged his horse for a cow,) and raised his crop for the first few years entirely on burnt land. He practiced mixed husbandry, his wheat and vegetables being consumed at home, while his oats were sold to lumbermen. By the time he had grass to cut he had managed to procure a little stock to consume his hay, and has continued to consume his hay on the farm. His farm is well stocked with horned cattle and sheep. He has erected buildings at an expense of more than $2,000, is nearly free from debt, and is what we call an "independent farmer." A great many other instances of successful farming in Aroostook County might be enumerated.

New Hampshire.—The secretary of the New Hampshire Board of Agriculture, Mr. J. O. Adams, sent to towns, in obedience to legislative requirement, a statistical circular, involving the question of the profits of farming, that of the comparative tendency to emigration, and other practical inquiries, answers to which are published in his last annual report. Not all of the towns made returns, and some of the returns were silent or indefinite as to the profit of farming enterprise; but a classification of one hundred and forty-one such answers presents a list of fifty-five towns in which none of the farmers are "making money," and one of fifty-three in which a few only are making headway in accumulation. Four counties are represented by one prosperous farmer in each; others by "one or two," "occasionally one," or "one in a hundred;" seven give percentages of money-makers ranging from 1 to 25; one reports one-third, another one-half, a third "more than half," and still another "a bare majority;" while in others "a majority are saving a little," "farming pays," "some stock-farmers" are prospering. This gives a fair idea of the report, and probably an estimate lower than the real proportion of farmers that save money in the several counties, because the reports are evidently, in some instances, tinted with the bright hopefulness or tinged with the despondency of the reporters.

New Durham illustrates well the prevalent combination of agriculture with other industries, having seventy-five who are both farmers and shoemakers, and only thirty who are farmers solely; and in Atkinson, these classes are respectively thirty and fifty-five. In Candia few farmers are prospering, because, among other reasons, they "neglect their farms, and do not devote the time and money to them that they would to other business." At the same time the reporter acknowledges that farm-buildings are better than in former days, that such conveniences as sewing-machines in the house, and mowing-machines out of doors are common, and that there is more money at interest and less economy than formerly. In Hampton Falls, where farmers are said to be merely "supporting their families," it is said that they "do not work all the time," and that farming, "for the time and labor bestowed upon it, probably pays better than any other business conducted in a similar manner." The high price of labor is very generally deemed an obstacle to profitable farming, but in Kensington it is acknowledged that "those farmers in town who have had plenty of help in the house and out of doors, are about the only ones who have made any money by farming in the last few years." No farmers are making money in Sandown, for the reason that "their lands are worn out, or grown over with wood and bushes." In Rollinsford none are growing poor by farming, and nearly all are increasing their means, their cash products being garden-vegetables, milk, fruit, and hay. The money-makers in Centre Harbor are stock-growers. The town clerk of Freedom is free to say, and sorry to say it, that no one in town is living solely from the farm, and that "there seems to be a lack of energy and enterprise." One farm in Tamworth is earning a profit without deterioration in growing white beans for market. In Dunbarton the best farmers agree that none are "making money solely by farming and at the same time keeping up the value of their farms and supporting their families." They may not know an equally indisputable fact, that scarcely one in a hundred of the laboring men of the world can do more than support their families; and certainly not half of them can give their families as good a support as that enjoyed by Dunbarton farmers.

Near the cities a spirit of enterprise is caught from the prevailing activity. Market facilities are improved more wisely. In Manchester "Many of the small farms pay better than the business of mechanics." In Claremont, farmers "are saving more money than the average of mechanics and men engaged in mercantile pursuits who have an equal amount invested in their business and houses." The estimate of interest on farm-capital in Rochester and Rollingsford is 6 per cent. Unfortunately there is no return from Concord, Nashua, Portsmouth, or Dover, where similar facts might be supposed to exist. In Bedford, near Manchester, 6 per cent. is realized, largely from milk, of which $85,000 worth annually is sold, and "young people stay at home generally, because they can make farming pay."

In nearly all these reports the continued exodus of farmers' sons is affirmed. In more than half specific estimates are made of the proportion emigrating. It amounts to nearly six-tenths, and it would probably be safe to say that more than half of the boys of the farms of New Hampshire leave their paternal acres. As might be expected, where the profit is largest the migration is least. It is said that "farming pays in Hollis." Sequence: "Boys stand by the old homestead better than in neighboring towns." This town is near Nashua, a manufacturing city; and Hudson on the other side, yields "5 or 6 per cent., and fewer boys leave the farm than in many other towns." In Farmington "no farmers are

making money and supporting their families;" consequently "all leave town who know enough."

The return of estimated percentage of profit or real rental value of farms is an exceedingly gloomy exhibit, in most cases making the profit nothing, and in a score or more of towns where profits were definitely estimated the average is about 3 per cent. In the whole State, on the basis of these returns, the average could not be 2 per cent.—indeed it could scarcely be more than 1. Very little reliance should be placed upon them, the universal idea being that one hundred days' labor in the fields, and two hundred or more in warming and feeding inmates of the house and barn, should support and clothe and school a family, with advanced views of necessary comforts and admissible luxuries, and the surplus, if any, after deducting an additional sum to represent the profits of *labor*, should be credited as profits of *capital*. It is asking too much for the real productive labor done, the half a dozen or half a score of acres actually tilled, especially if a systematic starving of these acres is practiced.

Examine, for example, the labor-account and the list of products of that labor in the Dunbarton report:

Average income.—One hundred bushels corn, one hundred and fifty bushels potatoes, $190; 25 bushels of wheat, 75 bushels of oats, $95; growth of stock, $150; income of five cows, $200; pork sold, $30. The growth of wood on this farm is small, say $50; inprovements, $50; fruit, $100; income of kitchen-garden, $15. To this might be added 20 cords of wood, for fire, worth on the stump $20; making a sum total of $900 To this amount may be added house-rent, which I think should be reckoned in favor of the farm.

Expenditures.—Labor of man and wife, $500,(a low estimate;) first-class hired man, $25 per month; board in addition, $12, amounting to $37 per month, or $444 per year; taxes, which are lower in this town than in most towns, $100; blacksmith's bills, $25; wear and tear of tools, carts, carriages, harnesses, &c., $50; fertilizers, seeds, and grain, $50; annual repair of buildings, $50; to this should be added the help of two boys belonging to the family, with some extra help by the day, &c., also the help of two girls in the house, who take the place of a girl hired, the whole being reckoned low at $200; thus making the whole amount of the really necessary expenses of the farm $1,419, leaving a balance against the farm of $519. The question then comes, how does this farmer live? Well, how does he? Five hundred and nineteen dollars against him in the management of the farm, to which may be added the interest of a $6,000 establishment, including farm, tools, carriages, stock, &c., $360 more, amounting to $879. Then there are the necessary expenses of the family, such as clothing, books and papers, schooling, groceries, and many other things, swelling the amount, perhaps, to the round sum of $1,500. To live, in the first place, the man and wife must cross out their salaries of $500; that of the children must also be erased, making $700, save a few dollars paid for extra help by the day and otherwise. Then the interest on the estate must not be reckoned—$360 more, and we have $1,060. The board of the hired man is also reckoned out, $144 more, giving a sum total of $1,204. There is still a deficiency which must be made up in various ways, of nearly $300: sometimes, by taking a few boarders in the summer, or by cutting and selling a little extra wood and timber, or more often, at the neglect of the educational interests of the family, or in the necessary rest or clothing of the housewife, or it may be sometimes by a little outside speculation.

Here are three acres in corn, three in oats, one and a half in potatoes, about the same in wheat, or nine acres in cultivation, with the care of five cows; and two men and two boys, with the wife and two girls, assigned to do the work, and $1,144 placed to their credit in payment for this work. One black man in the South would be required to care for twice as many acres, and a white one in the West three times as many.* This looks too much like playing at farming, and, perhaps, supposes the training of a Black Hawk trotter in summer, and a carnival of sleigh-riding in the long winter. It is diluting labor too much for profitable results.

* In California, on the Dr. Glenn farm, 36,000 acres of wheat have been seeded for the harvest of 1875, with 1,000 mules and 300 men—one man to 120 acres and one mule to 36 acres. Five months can be employed in seeding if rains come early to soften the soil.

The amount of false logic in these returns is fearful. Note the following: "If a young man should start in farming at twenty-one with $2,000, after ten years of hard labor he might have added to it $1,000. Should he invest it at 8 per cent. and allow it to accumulate, by the time he was fifty-three years old he would be worth $32,000. Farmers could not make money like that." Of one hundred mechanics with incomes from labor of $600 each, and from $2,000 invested of $160 each, how many would save the interest and be worth $32,000 at fifty-three years of age? Probably not ten. The fact is, not one in ten, either farmers or mechanics, fail to expend nearly their whole income, year by year, through life, whether the income be large or small. In the case named above, of the young farmer, at the rate of increase acknowledged not only as probable, but given as an average, he would be worth about $15,000 at seventy, which is a far greater sum than the average mechanic of that age can boast of possessing.

If profits are in so many cases unsatisfactory, the evidence of these returns, as a whole and in detail, points to the fact that too little labor is employed, too little capital used, the land kept on half rations, and the gross cash returns for land and labor little more than half what they should be.

The skinning process is almost everywhere in vogue. All sorts of excuses are made for it. Their fathers did it. Labor costs too much for good cultivation. Taxation is a discouraging disability and expense. United States bonds are exempt, and farms are not. Perhaps it would have been better if their interest had been made 7 per cent., subject to taxation. Because patriotic men risked their money in perilous days in loaning to the Government, and obtained immunity from taxation as a portion of the interest, unpatriotic farmers who refused thus to risk their savings become discouraged and determine to skin their farms, sell their wood and timber, reduce their productiveness by converting their fertility into cash crops without any effort at recuperation, "get what money they can out of them, and let them go to the highest bidder, and store away the money, and hide it from taxation." Thus would they "cut off their noses to spite their faces." Is this legitimate farming? Such feeling in Deering takes this form: "So long as every dollar of money which can be gleaned from the robbery of our farms and carried to the banks and by banks to build cities and railroads in the far West, and all the burdens of public taxes fall upon those who cultivate the soil, just so long will the occupation of the farmer here in New Hampshire be at a discount." This accumulation by skinning is an ultimate increase of poverty. Lyndeborough understands this: "The reason so little money is made is the want of more capital." Because fertility is decreased and cash for labor-saving implements is lacking, one hundred dollars' worth of labor secured a return of $80, when the income should be $150. What per cent. is made on such an investment?

Now, let us turn from these melancholy views to those more cheerful; original letters on this subject, with bits of suggestive personal experience, showing that shrewd and energetic farmers do make money from the granitic soil of New Hampshire. The following extract is from Mr. Levi Bartlett, of Warner:

There are so many contingencies connected with the carrying on of farming, manufacturing, mercantile, and commercial pursuits, that, of the individuals engaged in any of the above-named enterprises, some will succeed, while others will as surely fail. But absolute failures among the farmers of New England in proportion to the numbers engaged in agriculture, are vastly less in proportion to those engaged in other pursuits. Great changes have taken place in the last half-century. During that period great numbers of what were once considered good farms in this and other towns in this county have been given up as

farms, the families dispersed, the buildings removed, most of the lands turned out to grazing, and large portions of the old fields are making a forest-growth. There are various reasons, too numerous to mention, why things are so, but such are the facts, resulting in a decreasing population in all the long-settled towns in this section, unless large manufacturing establishments h ve been introduced into these towns. In such towns they retain most of their native population, and largely increase it from outsiders, who have a strong desire to seek employment in manufacturing villages and cities, rendering farm-labor scarce and high-priced.

But, on the other hand, there are in all these towns numerous enterprising, go-ahead farmers, who have naturally good farms, and manage their affairs with energy and skill, that "do make farming—legitimate farming—pay." Their tasteful, well finished and furnished houses, costly barns, horses and carriages, herds and flocks, freeness from debt, money invested in banks or railroad-stock, or deposits in savings-banks, are proof positive that this class of New England farmers make farming pay, and such are found in large numbers in all our towns. Most of this class pursue what is termed "mixed husbandry," though many make wool-growing a specialty. Some others, where favorably located, make the sale of hay an object, and this they accomplish without decreasing the fertility of their farms.

Mr. J. F. Dodge, of Nashua, N. H., averages a product of about $400 per annum from two acres, a little more than half of which is cultivated in common garden-vegetables, and the remainder, a steep hill-side, utilized as an apple-orchard. He makes the following statement, showing receipts of $130 from less than one-fourth of an acre and a few days' work, and a net profit, after allowing for interest on $1,000 per acre, at the rate of $366 per acre:

The soil is a fine sandy loam, light, warm, and deep, cultivatedabout forty years in succession, replenished annually with about four cords stable-manure to the acre. May 27, 1873, I planted about thirty-six square rods in Boston marrow squashes. The manure was spread and plowed in, plowing ten inches deep; hills seven or eight feet apart, and but two or three plants left in a hill after danger from bugs was past; used in each hill two shovelfuls well-prepared night-soil, mixing well with the soil, and making broad, deep hills. Both the striped and black bugs were plenty. The striped were kept off pretty effectually by sprinkling dust from beside the hills on the young vines while the dew was on. The black ones, or "pumpkin-bugs," were trapped and dispatched by placing a shingle close to the vines in each hill, on the under side of which the stupid fellows were sure to be found early in the morning, or later, if the weather was cool or cloudy, ready for the application of another shingle carried in the hand. The first of the crop was gathered August 12, the last about the 1st of October. Much of the cultivation was done with a wheel-hoe.

Receipts.

Sales of squashes, at about $2.50 per hundred weight	$120 43
Beans, corn, cabbage, tomatoes, and mustard	9 68
Total	130 11

Expenditures.

Interest on land, at rate of $1,000 per acre	$13 50	
Stable-manure and night-soil	12 00	
Plowing, hauling, and spreading manure	3 75	
Seed, $1.18; bean-poles, 20 cents	1 38	
Labor, at $2 per day	15 40	
Carting squashes	1 75	
		47 78
Net proceeds		82 33

Mr. O. A. J. Vaughn, of Laconia, who has enjoyed peculiar facilities for knowing the financial standing of farmers in his region, makes some suggestive statements, showing increase in individual wealth of the most substantial character, even with due allowance for some inflation of values:

I look upon the assertion that "farming does not pay" as a senseless cry. There is no doubt whatever but that a farmer in New Hampshire, with the same labor that is bestowed on a farm in the Western States, can make more money than his western competitor. It requires about four times as much product West to realize a dollar as it does in this State

and the same labor there will not produce four times as much. There never was a time in the history of this State when farming paid better than during the last ten or twelve years. Farmers in that time, who have worked as their fathers worked on the same farms, or others just as good, have made more money than their fathers or grandfathers ever did or ever hoped to. Every kind of product has found a ready sale at home at the highest price Those who have not sown have not reaped, or, in other words, those who have not labored have not grown rich—while those who have labored have found a profitable harvest.

Some of the most wealthy men in Belknap County are farmers, and have made their money exclusively by that occupation. Let me give an instance. In 1860 a farmer in an adjoining town, Gilford, gave to the census marshal on his entire estate $5,500 in value. In 1870, the same man gave it in at $30,000. The increase in his wealth had come solely from farming. There had been no increase in the value of his land, except as he had added to his acres. His land had a better producing quality, but per acre would not have sold higher, nor would it now, than in 1860. His was a general farming business. If he had any specialty, it was wool-growing, a few cattle, and occasionally a horse, and a little hay. Another farmer in the same town, in 1860, gave his estate at $20,000; in 1870 he gave it at $60,000. Some portion of this increase is due to a rise in the value of a piece of timber-land, but is largely due to his purely farming business. So throughout this whole town an examination of the census-returns shows that on an average the farmers considerably more than doubled their estate in that decade.

A farmer in Gilmanton, same county, commenced, at the age of twenty-one years, on a small farm in that town. It is true he labored hard, as did his helpmate in life. He stuck by his farm; but not closer than does a good mechanic to his trade, or the average professional man to his calling. All his accumulations he added to his farm, either in improvements or increase of acreage. He had no income except from his land and labor. He died recently, at the age of sixty-five. The little farm had grown to 1,000 acres, with three good sets of farm-buildings on it, and the real estate was worth, even at the low rates at which land is held, more than $20,000. What amount of personal estate he left is not known. He cut on an average 200 tons of hay a year, and fed it on his farm to his own stock, keeping from 75 to 100 head of neat stock, 100 to 200 sheep, work-horses, &c. He got his money from the sale of stock, horses, work and wool, with some, but not much, grain. He realized nothing from the sale of wood or timber, as he was too remote from market to sell these to advantage. He rarely used artificial fertilizers, keeping up the quality of his land by the use of barn-yard and stable manure. The same thing in regard to fertilizers is true of most of our most successful farmers.

Persistent farming, like persistent labor at anything else will bring its sure reward. It opens no sudden road to great wealth. The instances I have given are but fair examples of what may be found in all the towns in this county.

The more enterprising managers of small farms in each town are fairly represented in the case presented by Mr. Kimball Webster, of Hudson:

"Does farming pay in New Hampshire?" is a question almost certain to be answered negatively by the careless, the indolent, and the unsystematic farmer; but within our own town-limits I can point to a score of farmers who are making farming pay by exercising a due amount of skill and judgment; no more, however, than any other branch of business would require to make it a success, and giving due attention and energy, and devoting their labor exclusively to their farming interests.

As an instance of successful farming, I cite the case of Lucien M. Tolles, one of my neighbors. His farm, some seven years since, cost him $6,500. His stock and tools are probably worth from $1,500 to $2,000, making the amount of capital invested something over $8,000. In the year ending April 1, 1874, he produced and sold 21,362 quarts of milk for $1,281; 750 bushels of potatoes, $470; 900 dozen eggs, $250; beef and pork, $100. Total, $2,101. The expenses were: hired help, $160; interest on investment, about $500; wear and tear of tools, &c., $150; grain bought, $300; taxes, $67—total, $1,177. Balance in favor of farm, including his own labor, $924. In this estimate, which is from his own figures—and he keeps a strict account—is not included many small amounts for produce sold and consumed at home. He keeps about twelve cows and two horses, selling milk and consuming all his hay on the farm; raising potatoes and buying the principal part of the grain consumed. He keeps about one hundred hens, and some years buys some manure. His farm is constantly increasing in fertility and value.

Here is mention of a hill-farm in Sullivan County, of rough land, valued at only $12 per acre, conducted in the old-fashioned way. The cash-receipts appear to be all derived from farm-stock, of which very little is from the dairy, the care of which consists of feeding in winter, sheep-shearing in spring, and, perhaps, hog-killing in autumn. The

"mixed husbandry" helps feed the family, and very little cash is paid out for living-expenses. The letter is from Mr. J. M. Wilmarth:

If the third annual report of the New Hampshire board of agriculture is to be relied on, farming does not pay in this State. But my field of operation is limited to that part of New Hampshire included in the county of Sullivan, and here, as far as my observation extends, farming, as generally conducted, does not yield a very generous return. Those who follow that occupation support their families and but little more, but where farmers exhibit a reasonable amount of diligence, skill, and economy, they live as comfortably and are as apt to accumulate profits as our mechanics. They form the most independent class among us, are but little affected by panics, and have no need of bankrupt-laws for their relief. One reason why farming pays so little in this part of the country is the imperfect manner in which it is conducted. As a general thing the farms are too large, and wages, in doors and out, are too high to make farming profitable.

A farmer in our county, of thirty years' experience in farming, has a farm of 500 acres, valued at $6,000, exclusive of wood-land; live stock valued at $2,000, and has followed a system of mixed husbandry. The following table exhibits the annual average receipts and expenditures for the last five years:

INCOME.		EXPENDITURES.	
From sheep	$500	Interest on farm	$360
" horses	150	Interest on live stock	120
" cattle	100	Hired labor	450
" dairy	75	Taxes	125
" hogs	125	Use of farming-tools	50
" poultry	100		
Profit of boarding	125		
Betterment of the farm	50		
Total	$1,225	Total	$1,105

Leaving as profit $120 in favor of the farm.

Mr. J. L. Hersey, of Carroll County, thus notices a farm in Tamworth:

The Hubbard farm, in Tamworth, now occupied by Pike Perkins, contains about four hundred acres, and is so level that from his door one can gaze over the most of it. Last year he cut one hundred tons of hay, mostly by machinery, that would have sold for $15 per ton; three hundred bushels of corn, that would sell at $1 per bushel; three hundred bushels of potatoes; one hundred and twelve bushels of beans, that sold at the house for $4 per bushel. Wheat and oats he did not find out the number of bushels, but presumes in a like proportion. He wintered fifty-one head of cattle. Out of that number were ten yoke of oxen and six cows, three horses that would command a high price in the market, twenty-three head of sheep in fair condition. His barn is a model of neatness. Mr. Perkins clears $1,000 per year. Now, who will say that farming does not pay? Only the man who lacks energy.

Here is a record of moderate gains, by an unambitious effort in a quiet way, similar to scores of others in every community, as reported by Mr. R. G. Cochran, of Francestown, Hillsborough County:

A friend of mine took possession of a farm, some $2,500 in debt. He expended enough more to put a cellar under a very large barn, and at once commenced placing soil, sand, and whatever would add to the value of his manure, under his cattle and horse stables, and in his barn-yard. By this course, with thorough culture and top-dressing, for some fifteen years he supported his family, a wife and several children, his father and mother, paid off the debt, and found his farm producing double its original yield. From some experience and extensive observation it is my opinion that farming does pay as well or better than most kinds of business in all that constitutes real independence, health, and moral and mental strength.

Another farmer, Mr. B. Frank Brown, of Tilton, tells us how in seven years he brought up a farm that could feed but one cow to the point of carrying twelve to twenty:

There is only now and then a farmer in New England who makes his business pay, for the reason that he does not go at it with that energy, forethought, and perseverance which characterizes the actions of our merchants and business men generally. The average

farmer works well a few months and takes his ease the rest of the year. Most of them tread the beaten paths of their forefathers; they do not think for themselves and act on the result of thought, like merchants. The farmer should understand his soil and know what it is adapted to raise to the best advantage; then concentrate his force in the right direction. Seven years ago I purchased some worn-out soil, (light,) about thirty acres. I raised only enough to keep one cow the first winter. I began to turn everything about the premises adapted to fertilizing to the best account. I turned the sink-water into the barn-cellar upon plenty of loam, and put a few hogs to work upon the loam. At first I bought corn to feed my hogs, and was careful to have loam enough for the absorption of all liquids which came in contact with it. The hogs brought enough to pay for the corn, and what they did for me was profit, as I was able to raise my fodder. I bought more cows and put loam for bedding and to absorb the liquid manure which went into the cellar, where the hogs could work it over. I have not kept many hogs, but generally from five to ten. I have bought very little of the commercial fertilizers, and what I have bought has cost at least double what it would have cost me to produce its value with loam and hogs. I have bought some ashes, and would much rather have money laid out in ashes at 25 to 30 cents per bushel than any commercial fertilizer at any market-price. I keep the dressing as near the top as possible and harrow it in. I believe in top-dressing grass just before the fall-rains, or in the spring after the grass is up far enough to shield it from the sun. I have treated my land as above stated, and now I am raising enough to keep from twelve to twenty cows from the same land that only produced enough for one seven years ago. If I raised corn I should buy a little superphosphate of lime to give it a start in the spring, unless my ground was very rich. As a rule it costs so much that the farmer cannot afford to buy it. Grass is usually the best crop in New England. Farmers should have a few tons of hay to sell, and buy western corn with the proceeds, and if they can hire money at 5 per cent. (its real cash-value) they may find it profitable to hire it to buy corn at 75 cents to $1 per bushel to feed hogs. But they must keep the dirt-cart busy, and they must keep the manure-heap under cover where it will not go to waste. A farmer may as well put his bank-notes in the fire as leave his manure-heap under the eaves-droppings of the buildings.

Mr. George Gilbert, of Keene, while acknowledging that farming does not pay well in New Hampshire as at present conducted, attributes the failure to conservative routine, a non-adaptation of crops to soils and circumstances, and a tendency to unnecessary expenditure above income:

The profits of farming depend, in a great measure, on a judicious management of the farm, but the *basis* of success is raising the particular crops for which the land to be cultivated is peculiarly adapted, and the produce most in command at a convenient market, or what can most profitably be turned into money; but it will not answer to follow any fixed routine of farming regardless of circumstances. What would work well in one location would bring disaster in another. Many persons having been accustomed in youth to performing work in a certain method, think there is no other way in which it can be done; and this class of persons, with one idea, is not small among us. Every man who has a farm of any extent, from two to two hundred acres, must have his plot of potatoes, corn, oats, &c., regardless of the expense of cultivating each particular lot, or of the value of the crop after it is harvested. The hoe is in requisition for the greater part of the labor necessary to raise each plant matured on the farm, from the time the first furrow is opened in the spring until the last tuber is stored in the cellar, at a cost of almost ceaseless toil, when a judicious selection of a proper crop and the use of appropriate machinery would have secured a harvest of much greater value with far less expense.

There are but few places on the lines of transportation from the West where a farmer can raise corn with any profit. He can purchase it at a price less than the cost of raising it; but that does not imply that he can raise no *other* crop advantageously. If he has land natural to grass, he can cultivate that with profit in almost every location; especially if he has pasturing for cattle during the summer; and the cattle will turn all the grass into manure, and still leave a large per cent. of its value on the premises in the form of a valuable manure-heap; then, with the manure and time necessary to secure a corn-crop, he can raise double its value of the best of English hay or clover; which, with a small addition of the western corn, will in the course of the winter convert his cattle into handsome beeves, filling his pockets with money in their sale, and still leave all the fertilizing elements of the hay, with the addition of the western corn in a valuable compost-heap, for the prospective growth of larger future crops. As a general rule hay will pay better as a crop in the majority of locations than anything else.

I would not convey the idea that the hay is to be sold and carried off to bring back the money; but as a rule should be fed to a stock of animals selected with reference to the demands of the neighboring market, either raising young cattle, or fattening older ones; unless one lives in the immediate vicinity of a village where manure can be purchased at a reasonable rate, in which case there will be no danger of impoverishing the land by the

sale of the hay. Where large quantities of milk and butter are required in the market, a stock of good dairy-cows will pay well for a portion of the farmers to keep. Beef can be raised by any farmer cheaper than he can purchase it, if he will take pains to save everything left by a fattening animal in the form of manure, greatly increasing his fertilizers at a small cost. On every farm remote from market, raising sheep for wool and mutton can be the leading object if the pastures are high and dry, for such alone can be good sheep-pastures. By carefully selecting breeding-ewes, and fattening all others as fast as they arrive at mature age, or as circumstances may require, fattening all the wether-lambs during their first winter, a person can often clear $2 per head net profit from his whole flock with but little trouble. Persons often make $4 per head, net profit, on selected flocks in fattening.

On most farms fruit can be raised at a small cost far more abundantly than is done at present. Not one-tenth part of the population make any strenuous efforts to increase the quantity or improve the quality of such fruits as we have.

Sugar-maples, growing by the fences around pastures and by roadsides, would, with a small primitive cost and a little after-care, make a source of revenue greater than is at present obtained from the whole farm without them, aside from the picturesque beauty they would everywhere add to the country. The wood of the sugar-maple is among the best for fuel, is very valuable as lumber for various mechanical purposes.

But there is one serious cause for so many failures in all parts of New England, and in all classes of society. We are, as a people, fast running into reckless extravagance. Our wants are mostly for the luxuries of life, and for display. Fickle fashion holds sway over most of our young people. We have forgotten that we are a plain, republican people, with the physical, moral, religious, civil, and political health of the future of our country as well as of our own children in our keeping; and our thoughtlessness is on the road to ruin. If we but observe the rules of economy and act wisely, I think the road from New England to Eden is no farther than from Florida, Indiana, or California.

Vermont.—The enterprising and systematic farmers of the Green Mountains are prosperous, although the State is almost exclusively agricultural. General or mixed farming is in vogue, usually with some prominent crop for a cash surplus, and such specialties as gilt-edged butter, pedigree merinos, and Morgan horses.

Mr. Z. E. Jameson, of Irasburg, Orleans, reports the management of a worn-out farm near his own, purchased nineteen years ago by Mr. G. B. Brewster, who, after a series of discouragements and failures, increased the productive capacity of his sterile acres to 25 bushels per acre of wheat, 70 of oats, 70 of corn, 300 of potatoes, and 900 of turnips, and the value of his estate from a few hundred dollars to $15,000.

Mr. Safford, whilom a member of the Vermont Board of Agriculture, bought contiguous tracts of land for $6,500, which are now worth $20,000, with a manifold increase of stock-carrying capacity, and large additions of barn accommodations and improvements.

Mr. J. A. Child, of Weybridge, Addison, says, after extensive observation east and west, that he has never seen anywhere better evidences of prosperity and wealth, as shown by fertile and well-kept farms and substantial buildings, than in the counties bordering on Lake Champlain, where farms sell at $40 to $50 per acre, and not unfrequently at $100.

Mr. Jonathan Lawrence, of Passumpsic, Caledonia, says that hundreds of farmers in his region made money during the war, while many bought additional farms, and find it less easy to pay for them than they had hoped. He gives a statement from Mr. E. A. Parks, showing an income of $2,265 from 325 acres, and expenses, amounting to $1,400, including $600 as interest on investment, leaving $865 above legal interest on cost of farm. One item is $1,490 from fifteen cows.

Mr. Samuel S. Kelton, of East Montpelier, Washington, thus gives his views and facts in illustration:

I will say that farming pays as well as any other business would in the same hands. As a class the farmers are as well off as any other; and in proportion to numbers there are less very rich and less very poor, a much larger proportion well-to-do. Their position, financially and socially, is very much better than fifty years ago. Enterprising young men, who do not receive parental or other assistance, work for hire until they save a thousand or

two, buy a farm worth $4,000 to $8,000, put on ten to twenty cows, and by middle age are out of debt and have reared a family bred to industry. A large proportion do not do so well; neither would they in any other business. It is the *man*, not the business, that tells. You ask for an example of success. In 1857 the writer's near neighbor died. His estate, appraised at $8,000 real, $2,000 personal, was bought by his oldest son, (aged twenty-three years,) who gave his notes for $8,000, took an incumbrance of $1,500, (the estimated support of a relative,) and paid $500 = $10,000. He kept a dairy stock, a few sheep, raised some colts, paid all his debts, bought an adjoining farm at $6,000. This man is now forty years of age. His farm of over three hundred acres would sell for $16,000. He has forty head of cattle, five horses, and some sheep, and does not owe as much as his personal property is worth. This I call success. You may think it small business, but remember we live in a small State, and do business in a small way.

Mr. E. R. Towle, of West Berkshire, Franklin, gives an instance of a young man buying a farm entirely on credit, in disregard of croakers, and with a result immediately successful:

Mr. Reuben Chaffee, a young married man, seven years ago purchased a farm of eighty acres in the town of Enosburgh, paying therefor $3,000. He only had sufficient capital to purchase stock and farming implements, running in debt for the land. It was a dry, gravelly soil, with some intervals of meadow; produced good crops of grain, and had good pastures. The purchase was considered as a wild speculation by his neighbors, who predicted failure as the result. He keeps usually twelve good cows, from which are annually made forty 50-pound tubs of butter. This is the principal product of the farm, and, one year with another, will amount to $600. The hay and grain are fed on the farm, but no feed is purchased. Excellent care is taken of the cows, and good management generally is exhibited upon the farm. Of the original sum paid for the farm only $700 now remains to be provided for, which is doing exceedingly well under the circumstances. I might, of course, have found a farmer who had done a larger business, but thought this would be of more importance, as showing what has been accomplished without capital by the exercise of labor, economy, and good management. There is no question but that good farming will pay in New England. The great want with most farmers is capital. With this rightly used, much more could be accomplished.

SOUTHERN NEW ENGLAND.

Massachusetts.—Returns from all parts of Massachusetts are full of illustrations of successful effort in agriculture, were further proof necessary. In one instance a farmer says he purchased 350 acres seven years previously for $12,000, with stock and tools $15,000, and could pay but $2,000 down. He had a dairy of 40 cows, and made some maple-sugar. His expenses at the start were $100 per month, and his receipts $200. He had no difficulty in paying his notes as they became due, and eventually resold the place to the former owner, who had returned disgusted from the West.

Mr. Allen Look, of West Tisbury, Dukes, acknowledges many instances of agricultural industry in his county, and believes it would be general if farming were properly conducted. He finds sheep-husbandry a profitable branch, and reports a flock of 100 ewes that had the previous year 100 lambs that were sold for $300, and 300 pounds of wool for $150 more; the cost of keeping being but a small portion of the gross proceeds. He mentions a field of three acres of bush-land, dressed with a compost of fish and peat, and sown with clover and timothy, yielding twelve tons of hay, sold for $240. With a similar top-dressing the next year, twelve tons and $360 were obtained. The land unbroken was considered nearly worthless for any other purpose. From a strawberry-patch of 25 rods, 15 bushels and 20 quarts of fruit brought $100.20, at the rate of $641 per acre. He declares it to be easier to get $100 in cash now than $50 twenty-five years ago. He hits the nail which confines this whole secret of farm-profits in saying, "I think extravagance has very much to do with the success of farmers, for it does not matter how much one gets from his farm if he is bound to spend it all."

Mr. William Sutton, of Ipswich, Essex, adds the following testimony to the success resulting from intelligent effort:

It is undoubtedly true that negligent farming is everywhere unprofitable, but I think it is equally certain that in New England, as elsewhere, the industrious, economical, and intelligent farmer is amply repaid for his toil. We may not here be able to boast of the remarkable crops which are sometimes exhibited in sections where a more generous soil awaits the labor of the husbandman, but steady, unremitted cultivation of our better class of farms has in repeated instances resulted in prosperity and wealth. I have now in mind the cases of two families, in my own immediate vicinity, (the Wares and Kings,) who have acquired ample fortunes in legitimate farming. The several brothers of these families, (and they number six in the latter instance,) are among the most prosperous of our people, and they have gained their fortunes entirely by the cultivation of the soil. They have been, in both families, engaged in the specialty of market-gardening, which they have followed from their youth up. And their success answers affirmatively and decidedly the question, "Does farming pay in New England?" I may mention also that in this town of Ipswich are instances of very successful farming in the hay-crop.

Mr. N. S. Hubbard, of Brimfield, Hampden, makes the following statement:

In reply to the first question I answer in the affirmative and also in the negative. And the same can be said of any other branch of industry. If the farmer puts forth the same energy that is exerted in other branches of industry, and uses his brain as well as his muscles, he will be sure of fair success although he cannot become suddenly rich. But there are advantages not to be found by the professional or business man. He partakes of the fruits of his own garden, field, and orchard, fresh, and which his own hands have cultivated, and is also comparatively free from the cares and perplexities of the business and professional man. In this immediate vicinity the dairy, perhaps, pays the best of anything in farming. Milk is sold for the city market or manufactured into butter and cheese, and is worth for that purpose 2½ cents per quart in summer, and in some cases a trifle more; in winter from 3½ to 4 cents for the city markets. This gives a product of from $45 to $75 per cow, and in some cases as high as $100. These prices, although low, give the farmer a fair income, and were it not for the fact that taxes fall proportionately heavy on the farmer, he would feel greater courage in his business. The most valuable of all crops in this vicinity, or even in Massachusetts, is the grass and hay crop.

Mr. David Folger, of Nantucket, gives some account of agriculture on that island, with a chapter in his own experience:

Like other business, farming, to be successful, must be managed with skill, energy, perseverance, and the necessary capital to furnish all the modern machines for cultivating and securing the crops in season, thereby saving an immense amount of hand-labor. If carried on in this way, I reply that farming in this county will pay, provided the farmer has capital to avail himself of the advantages which nature has provided in the way of fertilizers; for it must be admitted that to farm successfully in New England the farmer must have manure. The ocean throws up to us immense quantities of sea-weed and kelp during the fall and winter, the latter of which is a natural fertilizer, and can be applied as a top-dressing for grass-land, plowed in for hoed crops. The sea-weed is very valuable when dry for bedding for horses and cattle, and when worked into the barn-cellar, and composted with the droppings, makes a valuable manure. Our winters are so mild that most of the time the farmer's teams may be employed drawing onto the farm from this source a vast amount of material for enriching his crops and covering his grass-land with a never-failing top-dressing. I will give a brief account of my own plan of farming, with the average amount of crops for the last six or seven years, as it is not a fair statement to give the money-value of crops for one year, for, like 1873, it may be a partial failure from want of rain, or the farmer may have been making improvements from which he does not look for returns until the succeeding year.

I have 60 acres, the soil of which varies, well adapted to dairy-farming, which branch of farming I rely on mainly for my income. My stock consists on an average of ten cows, with a sufficient number of horses to do all the teaming, which is a large part of the work done on the farm, hauling from the shores kelp and sea-weed, which I use in every possible way, and always at a profit. Our cows are pastured on the farm, and from June to December require but little feed in the barn; as I top-dress my grass-land with compost manure or kelp, I allow my cows to crop the grass until winter, which usually gives them luxuriant fall-feed, the frost holding off on our island till very late, rarely freezing the grass until December, often until Christmas. Our winter-feed is as much English hay as they want, with two quarts of corn-meal and two quarts of shorts, twelve quarts of beets or carrots per day. The surplus hay that is sold pays the grain-bills. About one-half of the milk is sold at 6 cents per quart; the remainder is made into butter, which sells readily at 50 cents per pound. Sales of pork average 3,000 pounds, at 10 cents per pound.

I usually have about six acres of tillage, breaking up two or three acres of sward each year, and returning the same amount to grass again; plant corn on the sward-land after plowing in manure, and the crop has averaged 60 bushels shelled corn to the acre. The second year I plant potatoes, carrots, and mangel-wurtzel; for potatoes I plow in manure, plant in hills under kelp, cultivate both ways with horse; the crop averaging 250 bushels marketable potatoes. I have got 350 bushels of Jacksons from an acre. I raise some carrots for the horses and for first feeding the cows in winter, the crops averaging 800 bushels to the acre. I rely mainly on the mangolds, planted in drills, on loamy land, heavily manured, and get an average of 1,600 bushels to the acre. I have got 2,200 bushels from an acre. Our most important crop is hay, to the growth of which we devote a large part of the labor on the farm. The climate of this island is well suited for grass, and a larger portion of the soil bears good paying crops upon the application of fertilizers; my average crop is about three tons to the acre; I often cut four tons; the second crop grows readily on the old meadows that have been dressed. We always cut some, but my practice is to turn the cows on, for our mild winters rarely injure the roots of the grass, and a top-dressing makes all good again.

Mr. William Bacon, of Richmond, Berkshire, refers to instances in which farmers have commenced without capital, except health and pluck, who have raised and educated families, and retired in the meridian of life to enjoy a comfortable old age. He gives the following facts:

Some years ago Mr. A. came to this town and *rented* a farm. His small capital had been gained by renting farms. In a few years he bought one of the best farms in town, put the fences in good condition, built an expensive house, kept out of debt, raised and well educated a family of six children, bought more land, and died worth $15,000 This was all done by farming in New England. Another case: Mr. B. commenced the world with no capital, but his own strong arms and hands, and a strong determination to succeed. At his father's death he received a legacy of $1,000; has brought up a family: helped his sons in the outfit of life, and has just retired from business at the age of 65 with $7,000 now on hand. Mr. C. bought a farm entirely on credit, paid for it from its productions; bought another farm; paid down for it; done by farming, and no other means. Mr. D. was the son of a foreigner. His father was industrious, frugal, and strictly honest. His wife was an American, of good stock. Mr. D. was well educated, but early taught that his success must depend on his own resources. Hired out for a few years to get a start; kept an observing eye open and active hands busy. At the age of less than thirty-five years he is owner of a farm worth $7,000, well stocked, and is making money fast enough by farming to satisfy any reasonably honest man. Mr. E. is a farmer, about thirty-five years old; has a sick wife, unable to do the labor of farmers' wives. His business is farming; says he intends to clear $500 a year, and averages that amount. Need I extend the illustrations further? There are plenty of such cases, no doubt, in all towns. I have lately inquired among the Shakers, and their uniform answer is, "Yes, farming can be and is profitable."

Why should not farming be profitable in New England? We have a large population, to feed and clothe, which brings a market for everything the market can produce to our very doors, so there is no drawback for a market. Everything raised on the farm and garden finds ready sale at good prices; and here permit me to show the difference a few years have made. A farmer once told me he thought the then paying price for apples, 12 cents per bushel in the orchard or 16 in market, made it a good business. Now all the apples on those trees, and the same varieties, will bring $1 per bushel on the tree and much more in the market. I have known potatoes to sell at from 16 to 25 cents per bushel: the latter was considered a high price. Now, they are seldom less than 50 cents per bushel, and often $1. Turnips, that I have known to range from 6 to 12 cents per bushel, are now worth 50 cents, a standard price. Carrots, beets, &c., the same. Hay, once selling from $4.50 to $6 in the meadow, ready to draw, is now worth from $12 to $15, and last year $20 per ton. Straw, a drug a few years ago, disposed of at what the purchaser would give, is now worth $20 per ton. So we see that many of the productions of the farm have, in one man's life-time, yes, in half that period, doubled and often very much more than doubled in value. Thirty years ago oats were a drug in the market at 30 cents per bushel, now the prices range from 65 to 75, and so on in everything.

Much of our New England land, especially in the hill towns, has been hard run, without anything being done to keep up the condition of the soil. Such lands are very cheap. The only objection to them is, first, we have later springs, which makes plowed crops more uncertain, but for grass they are excellent. Then, when they are away from railroads a disadvantage is seen. New England now requires enormous quantities of beef for its consumption, and beef can be raised on these hills to a good profit. In so doing all the manure can be saved and applied in top-dressing, and so keeping up the fertility of the soil.

Rhode Island.—There are some good farmers in this little State, who are comfortable, and even thriving. A very moderate and con-

servative view is here taken by Mr. George A. Brown, of Middletown, Newport County, who unconsciously hints at high profits of agriculture in an expectation of anything like a surplus equal to the cost of labor of the farmer and his family, while apparently forgetting that nineteen out of twenty in other occupations have nothing left at the end of the year to show for the labor of the year:

It does pay when carried on judiciously and economically, and yet I am unacquainted with a single instance that has occurred within the limits of my observation in which a farmer has, for any considerable number of years, saved a cash profit equal to the market-prices of the labor expended by himself and family, and 6 per cent. of the whole amount of capital invested in the farm and stock in trade. I know that farmers do sometimes accumulate a considerable property by some means, such as trading in cattle, speculating in the products of other farms, or hiring farms at a rental of less than 2 per cent., and frequently less than ½ per cent. of their value, or by carrying on the business by the labor of himself and family, which, in some instances within my observation, would amount to $1,000 and even $1,500 per year, if hired at the market-price for such labor Sometimes a farmer will purchase a farm at a moderate price and in a few years sell it again at a large price without having made it materially better or expended much in improving it, but simply through the natural rise in value and the shrewdness of the man in buying and selling. "But," it will be asked, "how does farming pay if it will not yield a cash profit of the market-price of labor and legal interest on the capital employed?" I answer that cash is not the only result of all the toil, care, and energy of the farmer, (therefore that man whose sole end and aim in life is cash, and nothing but cash, would perhaps do better to avoid farming and select some more cash-paying business,) but the farmer enjoys many comforts, many blessings, and many luxuries, even, which are the legitimate products of his farm and his calling, and which cash will not purchase, and the denizens of the city cannot enjoy. But to be more particular, and make an estimate with which most New England will be well satisfied, let us suppose the farmer to hire a small farm worth $10,000, which is a moderate price for a farm in this county, and suppose that instead of 6 per cent. he saves 4=$400, and wages for himself and family at a low price per year, $600. This will give him a handsome income for the first year of $1,000. Suppose that he continues to receive $1,000 yearly for twenty years, and invests it annually when received, in some institution for savings, at 6 per cent. interest, he will have, at the end of the twenty years, $36,745, which, I think, is a very favorable showing, and is seldom reached, while a very large proportion of the farmers of this State do not save $100 per annum or $2,000 in twenty years. I think the principal reason why so few farmers acquire a competence is the want of energy, and of a disposition to save that which they get. They have too much of the disposition of the Missourian who, on being asked why he was idle, replied, "What do I want to work for? I have hog and hominy enough to last all winter;" for such, farming pays about as well as anything; the farm produces hog and hominy as nearly spontaneously as any place, while the really energetic, healthy, strong, prudent, and economical man of good business capacity will succeed in almost any calling, but I think will gain more money in almost any other business than farming in New England.

Connecticut.—Rev. William Clift, the well-known "Tim Bunker," of the Agriculturist, furnishes the following positive views and significant facts upon this question:

Answering for the State of Connecticut, the immediate field of my observation, I have no doubt that the men engaged in agriculture receive as fair a compensation for their labor in this occupation as they would in any other. The term "pay" does not mean simply the pecuniary rewards of labor, but all of comfort and thrift that labor brings in any shape—shelter, food, raiment, and the social and religious privileges without which money is of little use to the possessor. This comprehensive meaning of the term "pay" is generally overlooked in the discussion of this question. I will use it in this sense in what I have to say. Five hundred dollars a year in the city or village will not procure for the professional man or mechanic what most Connecticut farmers have directly as the result of their labor and of their location without any exchange of money.

Farming in Connecticut is in a transition state from the old style to the new: and probably not more than half of the agricultural population are out of the ruts and availing themselves of the improved methods and improvements of husbandry. I had occasion in the summer of 1873 to inquire for a horse-reaper to cut a large field of rye, and after diligent search and much riding I could hear of but a single implement of that kind, and that was a Buckeye of the old pattern, that had been laid upon the shelf several years. It is probably now the only horse-reaper owned in the county of New London, one of the richest counties in the state, that has had an agricultural society and yearly fairs for twenty years and more. Most of the rye raised in the county is still cut with the cradle, and farmers are exceedingly slow in adopting the new implements that transfer the labor of tillage and harvest from their

own muscles to the horse. But even for the lower grades of intelligence and labor applied to the farm, there is a fair reward and more of comfort gained than the same individuals could secure in any other calling. The old style farmer is intensely conservative, and wary of all new ideas and new implements. If he has abandoned the old wooden mold-board in the plow, it is rather because mechanics have forgotten how to make them, than his want of faith in them. He finds it difficult to get anything else than the iron plow, and adopts it under protest. He is shy of agricultural societies, of county and State fairs, of blooded stock, and of agricultural papers. He does not believe in new crops or new machines. His farm is cultivated just as his father worked it fifty years ago. He raises corn, potatoes, and oats, and his "woman," as he still calls his wife, makes butter and cheese, and raises poultry and eggs, and exchanges them at the village store for all the coffee, sugar, and tea used in the family. They are both saving and honest, and keep their side of the ledger-account at the store good year after year. No man ever lost a cent by them, and there is not the least chance for such a calamity in the future. A short account of one dozen in the eggs would keep them awake at night and spoil their thanksgiving. He raises nearly all his breadstuff except one barrel of flour a year, and the main staff of life is the Indian brown loaf, and johnny-cake; meat from the butcher's cart is the rare exception. He corns beef and pork, more than enough for his own use, and pays a part of his labor bills from the meat-casks in the cellar, which are always well filled and packed with Turk's Island salt. If he wants variety in spring, he kills a calf; if in the fall, he kills a sheep or fowls. He is always ready to exchange fresh meat with a neighbor, and only deals with the butcher on the credit side. He is easily seduced by that plausible caterer for village tables into selling his best calves, lambs, and turkeys. He is not yet fully persuaded in his own mind about barn-cellars, and continues to adorn the sides of his barn under the stable-windows with pyramidal paintings of manure-heaps. He carts dirt into the open yard every summer and carts it out again in the spring, with such additions as the stock may have made to it. He sells pork at the market-price and cannot tell whether it has cost him 6 or 10 cents a pound. He gets his best manure from the pig-stye, and guesses it pays to raise pork, because he thinks he gets the manure as clear profit.

Now I claim that this pretty large class of farmers, who do not know whether farming pays or not, are better rewarded for their labor upon the farm than they would be in any other calling. They get for their toil their house-rent, their fuel, their meats, fruits, and vegetables; live in great comfort, and usually save money after all theis expenses are paid. This class of farmers not infrequently have considerable sums in the savings-bank They are, with few exceptions, near to the school, the mill, the church, the library, and all the privileges which the village or city confers. The State has a mile of railroad to every five square miles of land, and six or eight miles' ride will bring almost every farmer to the depot, which is exactly in the center of the world. The mechanic, who generally resides in the village or city, and is paid in money for his labor, has to pay out nearly all that he receives for the means of living, which the farmer produces upon his own premises. He handles more money in the course of the year, but he has procured no more enjoyments for body or mind than the farmer.

But the husbandry of the state is by no means confined to the slow, conservative class I have described. There are many thoughtful, stirring men among the tillers of the soil, who take the papers and digest what they read. They are not afraid of new ideas, new crops, and new methods in husbandry. They comprehend the changes which have come over society in the last twenty-five years, and have adapted themselves fairly to their new circumstances. They study their location and the markets, and raise those crops which they can most economically turn into money. They comprehend the vast changes which railroads, canals, and steamers upon the great lakes and rivers have wrought in our communications with the fertile plains of the West, and do not attempt to compete with the crops which the new States must necessarily raise, and can raise cheaper than we. They do not raise much grain or pork for the general markets, but cultivate those crops that are consumed near home.

The tendency of our farming is every year more and more toward specialties. Some one or more staple articles are selected that always command a remunerative price, and the whole force of the farm is concentrated upon the production of these special crops. The supplies for the family are not overlooked. It is taken for granted that a cultivator of the soil can raise the fruits, vegetables, eggs, poultry, butter, and most of the meats consumed on the place cheaper than he can purchase them. The number of these special crops is already quite large, and is constantly increasing.

Along the sound, onions are a specialty, and a large trade is kept up between these districts and New York, both by rail and by sloop-navigation. The great center of this business is at Southport, which employs several vessels in shipping this crop to the city. The farmer who makes this a business cultivates from two to ten acres, according to his means. The ground is made very rich, and money is spent quite liberally for fertilizers, especially ashes, which pays better than almost any other manure on this crop. The crop is frequently cultivated, and the land is kept very clean. The same fields for several years in succession are kept in onions, and the fertility is maintained by frequent fertilizing. The aim is to produce from six hundred to eight hundred bushels of onions to the acre, and the price ranges from $1 to $2 per bushel. The crop keeps well, and as the farmers have from August until May

to market it, there is seldom a glut, and prices are almost uniformly remunerative. Farmers engaged in this business are improving their lands and their bank-accounts at the same time.

In the valley of the Connecticut, and in a few other towns, tobacco is made a specialty. The business has been pursued for years, and is steadily increasing. Horse-manure from the city stables, and fish scraps from the oil-factories along the shore, furnish the principal fertilizers which are purchased for this crop. It absorbs nearly all the manure made upon the farm, and the tobacco-fields generally grow rich at the expense of other portions of the farm; it yields ready money—from $200 to $400 per acre—and the temptation is strong to continue in a crop which gradually transfers the farmer's wealth from his soil to the savings-bank or some place less secure. Large barns and sheds are erected all through these districts for the curing of the crop.

There are still larger investments in truck-farming in the vicinity of all the large towns and villages. It is found to pay very much better to raise cabbage at 4 cents a pound than corn at 2. Six or eight tons of cabbage can be raised about as easily on an acre of land as a ton and a half of corn. The marketing of these vegetables is an every-day business from May to December, and it is mostly a cash trade.

Then there are farmers who make a business of supplying families in the village with fresh eggs, poultry, and meats. They raise all the poultry, eggs, sheep, and lambs the farm will carry, and purchase enough of others to supply their regular customers. Some of these farmers live ten or twelve miles from their markets, and visit them regularly once a week. The men engaged in this business generally have a genius for trade, and accumulate property much faster than those who confine themselves to the production of crops.

Besides these, we have fruit-farms, situated near railroads on the through-lines between New York and Boston, to take advantage of rapid transportation to these large cities. All the perishable small fruits from the remotest parts of the State can be put into these markets in from four to five hours. This business pays well, and is steadily increasing. It will be more satisfactory to the reader to look at several kinds of this special farming in detail.

The milk-farm of Mr. B. F. Williams, of Mystic Bridge, is more conveniently situated than most milk-farms in its nearness to market. The farm is not more than a half-mile from the center of the village in which the milk is distributed. It is not more than five minutes' ride from the milk-room to the beginning of the peddling, which takes place early every morning. The pail of the customer which is to receive the milk is left at the front door over night so that it can be filled from the wagon without any delay. It takes some two or three hours every morning to supply customers. This duty is attended to by the proprietor in person, and there is no opportunity for the adulteration of the milk without his knowledge. In other respects the farm is no better situated for the business than most other milk-farms in the State.

The farm is owned by Mr. Nathan S. Noyes, who lives upon the premises and occupies a part of the house. It consists of about 260 acres, of which 50 is in meadow, 15 in woodland, 10 or 12 in grain and hoed crops, and the remainder in pasture. There is a large reclaimed swamp that produces a good deal of grass, and a very large pasture, strewn with bowlders and a good deal occupied with brush and briers. The land, however, is very good, and yields grass of the best quality, though the quantity is but a small fraction of what might be produced if the land were cleared of rock and brush. The meadow-land is mostly intervals upon the banks of Pequotsop Brook, and was, without much doubt, cultivated by the aborigines when the country was first settled. It is quite free from stones, naturally a rich hazel-mold, that has been improved by thorough tillage and abundant fertilizers for many generations. The property was formerly owned by Mr. Joseph Griswold, who put up the present farm-house and out-buildings, which are unusually large and commodious. There is plenty of room for sheltering all the crops and stock, and for making all the manure under cover. The farm is leased at the halves, which is the more common method of leasing land in this region. The proprietor furnishes one-half the stock and one-half the seed, and takes one-half the products either in kind or in the money secured by sales, as may be agreed upon. Mr. Williams, in this case, is the salesman. The stock kept upon the farm for the year 1873 was 23 cows, of which about 18, on the average, were kept in milk; 1 yoke of oxen, 4 horses, 12 heifers and young stock, 50 adult sheep, 8 swine, 13 turkeys, and about 75 hens. The main business is the production of milk, and the stock is arranged mainly to supply milk, and, so far as practicable, to keep up the herd and to supply feed. The teams necessary to plow and till and do the farm work are employed a part of the time in teaming in the village, as opportunity offers.

The labor employed upon the farm is that of two men by the year, at $225 and board each, and occasional labor in harvest to the amount of $50 more, making about $500 as the labor-bill for the year, exclusive of board. This does not include the labor of Mr. Williams, who gives his whole attention to the business of the farm. Besides this, a woman is employed in the house to assist in the care of the milk-vessels, and the cooking and washing, at a cost of $150 per year and board. A part of this would very properly be chargeable to the farm-labor bill.

In the running of a milk-farm, a very large part of the vegetable products, of course, goes to the support of the herd, and does not appear in the list of products. Besides the grass,

hay, roots, and grain raised on the farm, Mr. Williams pays out about $350 a year for corn and provender, fed mainly to the cows.

The sales from the farm are, for milk in the six spring and summer months, 16,380 quarts, at 8 cents	$1310 40
In the remaining six months, $2,810 quarts, at 10 cents	1,281 00
Total milk-sales	2,591 40
Twelve calves, at $10 each	120 00
Beef slaughtered	100 00
Mutton and lambs	235 00
Wool	75 00
Pork	125 00
Pigs	40 00
Turkeys, $300; chickens, ducks, and eggs, $75	375 00
Hay, $125; potatoes, $50; apples, $25	200 00
Job-work done by the teams	1,500 00
	5,361 40
To this must be added at least, for meats, grain, and vegetables consumed by the two families	1,000 00
Making, as the gross product of the farm for the year 1873, from actual sales and the best estimate that can be made for the various articles consumed in the families	6,361 40

This farm lies upon the sea-shore, and large quantities of sea-wrack are thrown up every winter, which is used for manure to some extent. About 150 loads are drawn to the yards as absorbents. This sea-wrack is made up of eel-grass, rock-weed, kelp or ribbon-weed, and the fine sea-mosses. With an increase of the labor-bills it might be gathered in much larger quantities, and used to great advantage, upon both the pastures and the meadows. Its value is not sufficiently appreciated by our shore-farmers, who allow immense quantities to come upon the shore and be carried off again by the tides.

The facilities for saving the manure made by the stock kept upon the farm are unusually good. The farm-buildings are ample, and all the manure, except that in the pen yards, can be kept under cover. About 500 loads or half-cords are made from the stables and sties annually. The farm furnishes its own fertilizers, and can do so indefinitely if all its resources were used. It would probably pay to use sea-weed much more extensively, and to increase the bulk of the fertilizers made from the sties and stables.

To answer the question whether farming pays, we have only to look at the division of the products of the farm made annually by the proprietor and the tenant. It certainly pays the proprietor. He has his house-rent, fuel, and a good part of his living, consisting of pork, turkeys, chickens, eggs, fruits, and garden-products, free from the farm, besides his half of the sales. If we deduct $1,500 put down for team-work, we have $3,861 as the gross amount of the other sales. One-half of this would be $1,930. This is a much larger income than mechanics receive, and is far beyond the average yearly income of men in the learned professions. The show for the tenant is also very respectable. He receives for his services his house-rent, fuel, and nearly all his provisions; his half of the sales, amounting to $1,930, and all the job-work, amounting to $1,500 = $3,430. From this is to be deducted $650 for labor, and $350 for grain and provender, making an income of $2,430 annually. The farm is within a half-mile of school, church, store, post-office, and both families possess all the social advantages of a residence in the village. It would seem, then, from this instance, that it pays reasonably well to own a farm and lease it. We are unable to state the amount of capital invested in the farm, for it was purchased when property was low, and several parcels of it have been sold at very high prices. Reckoning the house-rent, fuel, and family supplies at fair prices, the whole receipts would show very handsome dividends upon the investments that ought to satisfy any capitalist who invests in real estate. The principal part of the tenant's investment is in his stock, farming-tools, and vehicles, and seed. The seed is mainly supplied from the farm, and the stock of cows is partly supplied from the heifers annually raised. There is of course considerable loss in the exchange of dry for new milch cows in order to keep up the regular supply of milk. But with all drawbacks, the showing is a very handsome one for the personal service and small capital of the tenant-farmer.

It may be said that the success here is owing to the favorable situation of the farm, and that with a more distant market the profits might disappear altogether. We will take, then, a milk-farm in another part of the State, six or eight times as far from market, and in a much poorer district, where fertilizers are essential to profitable crops.

Spring Glen farm is owned by Mr. J. J. Webb, and is situated in the town of Hamden, about four and a half miles from New Haven, where the milk is marketed. The farm consists of 250 acres, nearly all of it of that thin gravelly and sandy loam which encompasses the city. The location was selected not so much for the good quality of the land as for the facilities for marketing in New Haven and its suburbs. Mr. Webb in the early part of his life was a trader across

the plains and in Mexico, and has seen a good deal of life upon the frontier. Fifteen years ago he returned to the East, and after looking around for some time for a home, concluded to settle in his native State, near the largest city, where there was a hungry market for all farm-products and a pretty sure prospect for a large increase in the value of land. The land was bought for a reasonable price for farming purposes, and whatever the advance may be in consequence of its nearness to the city will be net profit. It has more than doubled in value since the purchase. The main object of Mr. Webb has been in the management of the farm to improve the soil and make it a more perfect machine for producing crops economically. He has spent all the earnings of the farm and his capital freely for the accomplishment of this object, and has now a very complete establishment, good barns, with shelter for all farm-crops, and sixty head of cattle, water in all the stalls, apparatus for cutting and steaming food, and all the tools necessary for producing and storing crops in the most economical manner. He has invested about $[illegible]0,000 in his enterprise, besides the earnings of the farm, which is pretty good evidence that he believes that farming in Connecticut pays. He regards his first fifteen years as merely preparatory work for his future farming operations. He is not a capitalist residing in the city, engaged in mercantile pursuits, and resorting to the farm for his recreation, but lives upon it, and gives his personal attention to all its details. The brain-work apparent here in every direction is certainly enough for one man to perform. The stock upon the farm at present is 40 cows and heifers, of which 12 are pure short-horns, and nearly all the balance high grades, a yoke of oxen, nine horses, and a few Berkshire swine. Mr. Webb has experimented a good deal with the various breeds of cows for the production of milk, and has settled upon the short-horns as much the best for his purpose. His object, of course, is to secure a large flow of average quality of milk, so that there shall be no need to resort to the pump. These cows are fine specimens of the breed, weighing from 700 to 1,000 pounds each, and are kept in high condition. He feeds upon the principle that the yield of milk is in proportion to the amount of food consumed, and the most profitable cow is the one that consumes the most food. Though the main object is the production of milk for market, he raises from five to eight calves annually, to keep the herd good. When the cows begin to fail in their yield of milk, they are turned off to the butcher, and bring the same price as first-class steers. The sales of beef are an important item in the profits of the farm.

The preparation of milk for market is a matter of very great importance. The common impression that milk just from the cow will bear transportation better than that which is older is erroneous. Morning's milk would spoil before night, after a few miles' transportation in warm weather, if it were not properly cooled. The yield of milk daily is from 300 to 359 quarts. This milk, after straining, is put in the cans in a spring-house, and kept until the following morning, *i. e.*, from ten to twenty-four hours. The temperature is between 50° and 60°. Here it loses the animal heat and undergoes a curing process. At 3 o'clock in the morning the milkman starts on his daily trip to the city, four and a half miles distant, and is about six hours in serving his customers. It takes two horses and the labor of one man to attend to the sales. There is usually in the spring and early summer more milk than regular customers want, and this is fed principally to calves. In 1873 the milk produced was 111,121 quarts, of which 108,481 were sold. The loss in peddling was 2.27 per cent. The price was $6.47 per 100 wine-quarts, taking the season through. The amount of sales was $7,167.11. Going back ten years, in 1863 the production of milk was 55,987 quarts, and the price of milk was $3 48 per 100 quarts sold at the door. It will be seen that the production of milk has doubled in ten years, and that it pays better to peddle milk than to sell it at the door. This increased production of milk is probably a pretty fair indication of the increased productiveness and value of the farm.

The farm is managed mainly to produce forage-crops to supply food for the herd. But, besides these products, there is a large investment in brewers' grains, which are purchased in the vicinity. About 150 bushels are used every week, and these cost 10 cents a bushel for four months in the year, and 12 to 15 cents for the rest of the year. This would be over $800 a year paid out for grain. The food is steamed, and the usual charge for the steam-box is ten bushels of the brewers' grain, and the balance, two-thirds cut corn-fodder and one-third hay. This is found to make an excellent feed for milk and to keep the cows in good condition. All the manure made upon the farm is applied to the soil, and the principal crops are hay, sowed corn, rye, and roots. The first field that we come to is cropped with yellow-globe mangolds, a magnificent crop of at least 3,000 bushels on three acres. This is found to be excellent feed in the latter part of the winter, and is one of the best kinds of food for the production of milk. Then we come to a patch of potatoes yielding about 150 bushels to the acre. The peculiarity of the method here is, that the work of planting and cultivating is nearly all done without the hoe. They are covered with the plow and cultivated with the smoothing-harrow. This is entirely practicable, and three-quarters of the labor at least is saved. If this practice were adopted on all the farms it would double the profits of potato-culture and at the same time reduce the price. Pease and oats are grown, and the crop is followed by winter-rye. About 10 acres are in rye, and the yield is from 15 to 20 bushels to the acre. This pays well, on account of the demand for straw in the livery-stables, the straw bringing quite as much as the grain. The crop in which Mr. Webb takes special satisfaction is corn, both for grain and stalk. He claims that more nutritious

fodder can be got from an acre in this crop than in any other in this soil and climate, and as he cultivates it, it is unquestionably correct. The rows are 2 feet apart, and the corn is not sown so thick but that it grows some 10 or 12 feet high. The corn is cut before earing is completed, and after wilting is tied in small bundles with straw; the bundles are gathered in shocks and tied with yarn, and left to cure in the field. The variety used for this purpose is the Norfolk white, which gives the best satisfaction. Twenty-two tons of green fodder have been gathered from an acre. This constitutes a large part of the bulky feed of the cows during the winter. Cured at the right stage of growth, it contains a good deal of saccharine matter, and makes excellent milk.

Corn is also raised for the grain, and yields about 50 bushels to the acre, besides a large quantity of fodder. The mowing fields are in fine condition, and about 100 tons of hay are secured every year.

The labor employed upon the farm will average about seven hands by the year. The wages paid are $16 a month and board: $18 for short terms of service. Some of the laborers have cottages and live upon the place, and these furnish the board and lodging for the rest of the workmen. As a large part of the labor of the farm has gone in past years to improvements—clearing, draining, fencing, building, &c.—it would be impossible to tell the exact cost of these improvements, or the precise amount which the farm earns above its legitimate running expenses. The investment in the farm is all the while increasing, and is of such a character that Mr. Webb is very well satisfied with it. This is about all any man gets out of the use of his capital. He has now a machine that will produce farm-products to the amount of $10,000 annually, and is every year improving in its capacity to make dividends.

We find here one thing that an outsider could not have anticipated—the extreme difficulty which an honest producer of milk finds in putting a pure article upon the market. Unless he attend to the milking and the peddling in person, and watch every can in its passage from the spring-house to the family where it is consumed, the milk is liable to be watered. The man who has the care of the herd and sees to the milking very naturally wants to keep up the reputation of a good manager, and knows that the standard of his ability is the quantity of milk which he produces. Any shortcoming in his case in a dry time for milk is liable to be visited upon the pump, unless he has high moral qualities. The peddler, who starts on his route while it is yet dark, passes many pumps on his way to market, and, as he has many opportunities to sell extra milk besides the supply of his regular customers, and the danger of detection is small, he is tempted to manufacture the extra milk at an early stage of the route and put the proceeds in his own pocket. He is accountable only for the quantity of milk that he takes from the spring-house. It requires a good deal of integrity on the part of servants to resist these temptations, and constant watchfulness on the part of the milk-producer to guard his customers against fraud

These two examples give us a very good idea of the management of milk-farms in Connecticut, in the immediate vicinity of large markets. This business is growing in importance every year as the city and village population increases. It pays much better than butter at present prices, and has the advantage of saving much labor in the house. It is of course quite popular with farmers' wives and daughters. This kind of farming also tends to the improvement of the soil. Nearly all the vegetable crops are consumed upon the farm, and generally grain is purchased, which adds much to the value of the manure. If this is manufactured under cover, as it generally is, and is applied to the soil, the productiveness of the farm is constantly increased.

Another kind of farming that pays fairly is the raising of seeds to supply the trade in our large cities. This is sometimes carried on in connection with the nursery business or with truck-farming. The tendency of farming in the State at this time is more and more to specialties of this sort, in distinction from the old style of variety farming.

Mr. George F. Platt and brother are in the neighboring town of Milford, and improve 100 acres of land which they inherit from their father's estate. They have the advantage of being born upon the estate, and of being trained to the nursery business from their youth. The farm is rather elevated, but level, and the soil is a good sandy loam. Parts of it were once well supplied with bowlders, and the walls give evidence of abundant labor in the past in clearing the fields of rock. The fences are in unusually good condition. The raising of seeds here for the general market seems to have been an after-thought occasioned by the decline of the nursery business. The large nursery-men, situated near railroad depots or tide-water, with their army of runners and tree-peddlers, penetrating every farming district and rural village, have very seriously affected the smaller nursery-men, who formerly did a fair business in supplying the local trade. But this is not a very alarming evil in Connecticut, where men are trained to do a variety of things equally well, and a change of business often leads on to fortune.

The principal seeds raised are the mammoth squash, evergreen sweet corn, onions, beets, carrots, parsnips, lettuce, and beans. The seeds are marketed principally in New York and Boston, and among the Shakers. Shakers are generally supposed to raise their own seeds, but here is pretty good evidence that a portion of them at least are produced on orthodox soil, which perhaps will not harm their vitality. The sales of seed amount to $1,800 annually, and other products to $1,200, making a total of $3,000 for the annual sales. This does not

measure the productiveness of the farm, for two families are supplied with their fuel, grain, vegetables, fruits, milk, butter, eggs, and the most of their meats, making at least $2,000 more. Besides this, there is a generous treatment of the soil, and improvements are constantly being made, in clearing land, in fences and buildings. A new barn has just been put up with a basement story to accommodate the cleaning and packing of seeds for market. About twenty head of cattle and three horses are kept upon the place, and most of the manure is composted under cover. Besides these home-made manures, fish-scrap is purchased from the shore, and is found to be a very economical fertilizer.

There is a fine orchard now in full bearing, and the boughs, loaded with ruddy and golden fruit in the mellow days of October, were worth a long journey to see. They were of the choicest standard varieties, and mostly of winter-fruit, that will keep well until spring. The cultivation of late-keeping varieties adds much to the profits of the orchard, and is too generally overlooked by our farmers. An inexpensive cellar under the house or barn will keep the fruit in the greatest perfection until April, and at that time the same apples will bring $5 a barrel that could not have been sold in the fall for more than $2 or $3. There is also a pear-orchard set, not yet in full bearing, but showing very handsome specimens of the most popular pears for market. This will tell upon the future profits of the farm. The ground between the rows of trees is cultivated with currants, raspberries, and blackberries. These are raised both for the fruit and for plants to supply the nursery-trade. The orange-quince is also raised, and pays very well. The fruit and most other farm products, except seeds, are marketed in the neighboring cities of New Haven and Bridgeport, and the town of Derby.

A portion of the farm is devoted to the nursery business proper, and the trade is supplied with young apple, pear, quince, and peach trees, and with evergeen and ornamental shade-trees of various kinds.

The field where the mammoth squashes were raised was a goodly sight, though not up to the usual level of exhibition squashes. These squashes minister more to the love of show, which is a characteristic of our modern civilization, than to any really useful end. They can be raised to almost any size, from 100 to 300 pounds, by making the soil rich and thinning the fruits sufficiently. No agricultural or horticultural show is complete without its big squash, and if there is a half dozen of them the show is a success, whether there is a Hubbard or a Marblehead upon the tables or not. When it comes to feeding or cooking, an old-fashioned crook-neck would be worth a cart-load of the mammouth Chili among sensible people. However, we must have sensations, and the seeds sell for $2 a pound. Here, then, is a farm of a hundred acres, worked by four men, besides the proprietors, that yields a gross income of $5,000 and upwards. They are sharp, intelligent sons of the farm, enthusiastic in their calling, good citizens, interested in every thing that promotes the welfare of society. There are others in the same neighborhood engaged in seed-growing in connection with common husbandry; there is not much room to doubt that seed-husbandry pays.

There is still another kind of special farming that is carried on to a large extent in the western part of the State—the grazing of cattle during the summer; this is very well adapted to farmers remote from market, as the products of the year's industry can all be sent to market on the hoof and be disposed of at a single sale, if that is desirable. We visited last season the farm of Mr. O. B. King, near the village of Watertown. The farm consists of 240 acres of land, and is somewhat scattered; that part of it which lies near the village is under a high state of cultivation and yields very large crops of hay. The system which Mr. King adopts is a good illustration of the methods adopted in the south part of Litchfield County, the neighboring towns in Fairfield County, and to still greater extent in Putnam and Dutchess Counties in New York. The whole farm is devoted to grazing, with the exception of a few fields devoted to the raising of family supplies. Generally the bars of the mowing-fields are let down, and the whole farm is thrown into one pasture, over which the cattle have free range through the whole season. Cattle are purchased in Albany or other large markets as early in the spring as the fields will yield a good bite of grass. Three and four year old steers are generally selected, and a decided preference is given to short-horn blood. These animals, turned into good pastures, will gain 300 or 400 pounds in a season, and by September or October will be fit for the butcher, without any grain. The grazer expects to make a profit on this increase in the weight of the animal, and also an advance in the price of the live weight. The gain of 300 pounds in the weight of the animal, and 2 cents a pound in price, are important items in the business. It is not uncommon, in favorable years, to make a gain of $30 a head in grazing cattle. Where a farm will carry a bullock to the acre, as some of them do, this gives a very handsome return for the use of the land. The business requires a large capital and good judgment in buying and selling.

We found in Mr. King's pastures a luxuriant growth of grass and some fine specimens of short-horn and Devon bullocks quite ready for the butcher. An important item in his business is the trade in Devon-grade working-cattle. These are so much in demand, that they bring from $200 to $300 a yoke. These are picked up in lots of cattle purchased for grazing, and yield a better profit than the butcher can afford to give. We have visited several farms in this belt of country in former years, and have always had occasion to notice the good effects of this kind of grazing upon the fertility of the soil. The animals pur-

chased are generally adults, the bones are already formed, and there is no large demand upon the soil for phosphates. The animals graze in the pastures from spring to fall, and nearly everything consumed is returned to the soil. It is noticed in these farms that the feed improves from year to year, and many of them have been brought up within a few years so as to double their capacity for carrying stock. In some of them a small dressing of plaster is used, which brings in white clover and increases the feed. In some farms the effect of plaster is wonderful, and is the most economical fertilizer that can be used. In others no perceptible effect is discovered. This is an easy and genteel style of husbandry, but it requires more capital than most farmers possess to carry it on. After the animals are purchased and turned into pasture they require very little attention. Sales are oftentimes made to the neighboring butchers; so that one does not have to leave the farm to market his crop. The great advantages of this kind of husbandry are the steady improvement of the soil, the great economy of labor, and the comparative leisure of the winter. It is a specialty of grazing that may be almost indefinitely extended, and is well adapted to those hilly farms of New England, that are remote from the great markets. Beef is a staple article, and the higher grades will almost always bring remunerative prices. There is little danger of glutting the market, and the tendency in the seaboard States is toward higher prices, and likely to be for some years to come. There are large districts in New England where the old-style farming has ceased to be as remunerative as other callings, and multitudes turn from the plow to the anvil and loom; farm-buildings go to decay; and pastures and meadows grow up to brush and forest. Is there not a remedy in this kind of husbandry for these desolations in the older States? If these forsaken fields were devoted to the grazing of fattening cattle, the brush would be kept down, and the pastures would grow more fertile from year to year.

It is quite manifest from these cases that have been presented that the cultivation of the soil in this Commonwealth pays reasonably well. Even that style of husbandry to which is brought the least enterprise and the least capital secures more of comfort than the same families could hope for in any other calling. The capital is securely invested, and in most cases is increasing in value, notwithstanding the want of skill in the management. It is exceedingly rare to hear of a failure among farmers. In mercantile pursuits and in most kinds of business in the city failure is the rule rather than the exception. In the specialty farming, to which the state is so well adapted, labor, skill, and capital are as well rewarded as in most other pursuits. There is certainly nothing in the condition of our husbandry to drive so many of our young men to the temptations and uncertainties of business in our great cities.

Mr. T. S. Gold, secretary of the Board of Agriculture of Connecticut, gives the following explicit and satisfactory statement concerning the substantial farmers of his neighborhood and their prosperity:

Does farming pay in New England?—You ask a question which is often discussed in this age of inquiry, and your remark which follows explains the whole matter. It pays, "if managed with energy and skill and the use of necessary capital." Where brush is allowed to overrun the pastures and meadows, and weeds to choke the crops, we hear the cry that farming does not pay; that it is cheaper to buy corn and other products than to raise them.

It is true, I admit, that little judgment was used in first settling the country, and that many farms, or even larger districts, were cleared from the forests that should have been allowed to remain, to furnish timber for manufacturing and building, and shelter for fruits and crops. The introduction of agricultural machinery is rendering the culture of these rough portions and the gathering of the hay relatively more expensive than upon smoother land, and there is no doubt that some entire farms thus circumstanced fail to return to their owners a fair equivalent for the labor and capital employed, and that many other farms have some portions which are a drag upon their better parts, a sinking-fund to swallow up the profits derived from successful culture elsewhere. I do not refer to those expensive labors in clearing rocky land, or draining wet land, or reclaiming sandy land by ashes and lime or green crops, but to the continued culture of rough and impoverished lands, the gathering of hay from rough meadows, still mowed because they were once productive, and other like practices followed because under other circumstances they were profitable. Lands so situated that they cannot profitably be manured or even cultivated, because they are so difficult of access, must be classed here as not paying for the labor required. Wherever we find farmers laying aside these old-time ways, concentrating their energies upon their better lands, adapting their farming to the changing conditions of the times in stock, crops, and improved implements and machinery, we find them thrifty, enjoying the comforts and luxuries of life, with means to support society, to educate their children, laying up a comfortable competency for old age, and to give their children a better start in life than they themselves enjoyed.

Again, if farming does not pay, how is it that all the cultivators of the soil live? They always get their living by their occupation, not by dependence upon other callings. The agricultural laborer always has his sustenance and always secures his wages. The failure of a farmer to meet his obligations, unless he becomes involved by some outside venture, is a rarity so great that it may be said never to occur, while every community can

show examples of ruined fortunes, involving many other parties, in the more enticing walks of trade and manufactures. Agriculture absorbs and employs all men who fail in other avocations either from physical disability or other causes. The disjointed parts of lives spent in other callings, which absorb their mental powers and their physical training in periods of rest, are mostly spent in the culture of the earth. Agriculture has to feed all these and their families. Adventurers of every kind take rest and find renewed strength on the farm for new enterprises, and come back again often with blasted hopes and shattered health and fortunes.

The amount of physical labor expended in agriculture is large, the amount of mental is often small. The return for the quality and amount of labor and the risk incurred will compare favorably with, yes, even surpass, that in other departments of human industry. Agriculture, manufactures, commerce, and mining are the four great divisions. If some give greater average returns for the risks, labor, mental and physical, capital and skill, than others, I claim that this is in the order named. The returns of agriculture are slow but sure. Manufactures, giving employment to varied ability, furnish some examples of splendid success. Commerce and trade have their merchant-princes, but these are rare. The miner finds a vein of ore, a rich nugget, or a gem, but of all mining the baser metals afford the surest and best profits; so we are driven back to the conclusion that agriculture, the basis of national strength and wealth, is also the most sure and liberal in its support of those who practice it. As the other callings make greater demands for mental daring and capacity, so they give the corresponding examples of success.

Similar changes in all these departments of industry have occurred as we now meet in agriculture. Improved machinery and the economy of the division of labor has broken up the business of the clothier, the hatter, and many of the other trades in rural neighborhoods which enlivened every stream in New England. In their old form, these industries became unprofitable to develop in certain centers with increasing vigor. The abandoned mining-camps, the dismantled smelting-works in the Rocky Mountains, do not prove that the mining interests of Colorado and California are on the wane, that their rich placers of gold and silver cannot be relied upon; but rather only show that more enticing fields have for the time employed the labor and capital of the miners, and as some new processes and means of transportation are developed, many of these same deserted mines will again be wrought even more profitably than when first opened. So agriculture, giving up some old homesteads and many unprofitable fields, some labors and crops, directing its forces into new channels, with proper concentration of labor, which in a new country is always applied sparingly, is not in a state of decrepitude, but has a more hopeful outlook for the future than it has enjoyed in the past. The application of brains to farming is working there the same results and changes which it has wrought in all the other departments of labor. The ignorant, the stupid, and the inefficient are left in the lurch.

Notwithstanding the popular cry "no profits in farming," it is the carefully expressed opinion of those best qualified to judge that the average profits of farming in Connecticut are greater at this time than in the rest of the United States, and that we can show as striking examples of success in agricultural enterprises as any of the so-called more favored parties of our country; that our lands are not exhausted, and that we may rely as in the past upon a fair reward for persevering and intelligent industry. But your inquiry is for "particular examples," and that it be locally considered. I have thought perhaps it would as well be answered by taking the school-district in which I reside, which is entirely occupied by farmers. Cream Hill school-district is in the town of Cornwall, county of Litchfield, State of Connecticut. It embraces about four square miles, with ten farms; the soil in common with this section of New England is fertile, but the surface is much broken, and the fields were once so covered with stones and large bowlders that thirty years ago, though partially cleared of stones for fencing, not an acre was fit for the use of mowing-machine and horse-rake. The native timber is oak, chestnut, hickory, and other hard woods, which sprout rapidly when cut over, and about one-quarter of this territory is now wood. This growth of wood is used for building purposes, fencing, fuel, and is sold for making charcoal. It is worth $2 per cord, standing on our hills, for this use, and a considerable revenue is derived by some of our farmers by selling this wood to the iron-manufacturers. These lands can be cut over every twenty-five or thirty years, giving twenty to thirty cords per acre. Pastures that are too rough or too distant from the homesteads become covered with brush, growing again to forest, and about one-quarter is now in the transition stage. The remainder is clean permanent pasture, orchard, mowing-land, or devoted to rotation of crops and grass. Most of our mowing-land, though upon the hills, is never plowed, but its productiveness is maintained by top-dressing. We raise good crops of corn, oats, rye, potatoes, turnips, and other roots. Our orchards furnish an abundance of fruit for home use and a surplus for market. Our main reliance is upon our grass-pasturage and hay. The dairy is the principal interest, while we raise some young stock, sheep, swine, and poultry. Some raise all their own grain except wheat, which is but little sown; while others buy bran and corn as brought from the West. Several consecutive dry years has shortened our grass-crop, and we have now less stock than usual, and have this winter bought more grain than before. The improvements which I shall sketch all have been made within a period of about thirty years. They consist in the clearing up of rough land, draining of wet land,

planting of orchards, and the renewal or repair of houses, barns, and other farm-buildings. In particularizing I omit two small farms, as from age and physical debility their owners are not qualified to improve them. These men live and pay their debts, but cannot be called thrifty farmers. All have families, and have the means to provide for their education abroad when they advance beyond the facilities furnished by the public schools; all have accumulated substance and improved their farms and buildings. The land was largely acquired by inheritance, yet for various causes has had in good part to be paid for by the present occupants, and within the same thirty years, most of whom have had no other occupation or resources except such as are furnished by their farms. We all use plaster with success, and try other commercial fertilizers with caution. The land-owners all work with their own hands and hire but little help. One man for the year, at a cost of $250 or $300, and board, with a little extra help in haying, is about all the labor required on each farm in addition to that of the farmer and his sons. We erected a district school-house some twenty years since, at a cost of $2,500, on an acre of ground given for the purpose. For location and form it is a model, and what is better we fill it with home-grown productions. "Cream Hill" school-district does not share in the too common charge that the Yankee race is running out. The laborers, who are to some extent foreigners, furnish their full quota, but the American element has a controlling influence.

I do not know where I can go in the country to find agriculture more self-dependent and fairly remunerative than here, where accidental circumstances have not contributed largely to the result. The farmers' club of West Cornwall, now over thirty years old, has done its share in stimulating our farmers to a more intelligent practice of their calling; while by its support we have encouraged others, it has returned liberally to us for our labor in its behalf.

Beginning with the first farmer as you enter the district, Mr. E. D. Pratt, farming by himself about thirty years, 250 acres, inherited perhaps one-third. He has expended $7,000 in buildings; has cleared 40 acres, making heavy walls; planted a young orchard of three acres; mows about fifty acres; raises corn, oats, rye, potatoes, and roots; keeps two horses, one yoke of oxen, twenty cows, five young cattle; made butter and cheese till the last six years, but now sends milk to New York. The freight on the milk and returning the cans from New York is 60 cents per can, which is paid by the milkman. Many farmers pay a small commission of 10 cents per can for selling the milk and guaranteeing the returns; others make their own sales. Mr. Pratt commenced sending milk to New York, October 1, 1867, and has sent as follows:

	Number of cans.	Value.
October 1, 1867 to '68	1,314½	$1,853 92
October 1, 1868 to '69	1,103	1,689 00
October 1, 1869 to '70	1,143	1,772 96
October 1, 1870 to '71	1,221	1,865 57
October 1, 1871 to '72	1,368	2,380 94
October 1, 1872 to '73	1,405	2,096 50
October 1, 1873 to May 1, '74	715	1,117 26

As we all get about the same prices these returns may be considered as a fair representation for all those farms that send milk.

Mr. J. P. Brewster commenced farming twenty-nine years since with 100 acres, for which he ran in debt, though an ancestral farm; now has 250; had $500 at that time; now is nearly out of debt; has expended $12,000 in buildings and heavy stone walls; has cleared 50 acres of rocky land, laying heavy walls, and underdraining; has planted three acres of orchard; keeps three horses, two yoke of oxen, twenty-seven cows, eleven young cattle, and a few sheep; formerly made butter and cheese; now sends milk to New York, about 1,500 cans, of forty quarts, per annum, which nets on an average about $1.40 per can.

My own farm adjoins that of Mr. Brewster. I commenced farming in 1840. Have about 450 acres, mostly from inheritance. This farm was cleared from the forest by my ancestors, four generations back. I keep fifty cows, two yoke of oxen, four horses, two mules, thirty-two young cattle, and thirty-five sheep. Changed from making butter and cheese six years since to sending milk. Send a little over 2,000 cans a year. The last year sent out 2,091 cans; net returns $2,738.24. Used milk also for family of fifteen or more, and made a supply of butter for over half the year. Also, raised sixteen calves on milk, and killed or sold calves to the value of over $100. My cattle are mostly Ayrshire and their grades. The fact that some of my cows are old and kept for breeders, and a large proportion young, two and three years old, is sufficient to account for the moderate amount of milk compared with other dairies in the vicinity. The surplus or unserviceable stock is usually converted into beef, and largely used in the family or sold to the farm-laborers, who have families and board themselves. Have received the present year, for wool, $50; for potatoes, $150;

for fruit, $500; wood and timber, $200; rent of houses to laborers, hay, and pasturage, $200. The gross receipts from the farm, besides family supplies, about $4,600. I employ for the year seven men and a boy, at a total cost, besides the board of four men, of $2,300. With this force I am enabled to do all ordinary repairs of farm-buildings, including painting: to build over one hundred rods, annually, of heavy stone-wall, clearing the fields, and draining when necessary. Work on the highway, and other labor outside of the farm, amounts to about $100 per year. My time is mostly otherwise employed; sothat lacking personal labor and supervision, I am obliged to hire more than if daily on the farm.

The profits of the farm largely go into improvements. These show 150 acres cleared, and fenced with heavy stone wall. In fact, most of the fences are of this character. I mow about 100 acres, mostly with the machine, whereas twenty years ago not an acre on the farm was fit for its use. I have 12 acres of young orcharding, apples and pears, just coming into bearing. Have expended about $20,000 in buildings, which are in good repair. Have on the farm six dwelling-houses and ten barns, with sheds, tool-houses, and other outbuildings. Have stable-room for one hundred and thirty head of cattle and horses. I have had other business than farming; as formerly a teacher of an agricultural school on the farm, and now as secretary of the Connecticut Board of Agriculture, so that if many of my neighbors, by farming alone, had not done relatively better than I have, it might be said that these were not legitimate returns of agriculture; but I can see great losses from my necessary neglect of my business, which personal supervision would have prevented.

Mr. R. M. Rexford has been farming about forty-five years on his paternal acres. By connection with an unfortunate manufacturing enterprise, he lost, some twenty years since, nearly all his property, which he has now regained by farming; has 175 acres; keeps eighteen cows, one yoke of oxen, two horses, and a few young cattle; sent to New York last year 1,100 cans of milk; farm has not been run to exhaustion, but he has not expended largely in buildings or improvements.

Mr. Chester Wickwire has been farming forty years; has 500 acres, partially inherited; has a large share of wood-land, from which he sells $500 to $1,000 worth annually, without diminishing the supply; keeps thirty-eight cows, three yoke of oxen, three horses, and twenty head of young cattle; raises his own grain, as corn, oats, and rye; makes butter and cheese, 300 pounds cheese and 75 pounds butter being a fair estimate of sales per cow. Calves raised or sold for veal bring $10 per head; cheese, from 11 to 12 cents per pound; butter, from 30 to 45. The refuse of the dairy for swine is of considerable value. Sales are made also of working-oxen, beef, potatoes, &c. The land is much broken, and many fields difficult of access. He made extensive improvements in clearing land from rocks, and his fences and buildings are in good order.

Mr. James Reed began farming forty years ago. At that time he had no means, buying the farm from his father in law. Mr. Reed died four years since. The widow manages the farm with her sons. The farm now embraces 300 acres; keeps twenty cows, two yoke of oxen, three horses, twenty-five sheep, and a few young cattle; sends about 1,200 cans of milk to New York. Mrs. Reed raises her own corn, oats, rye, and buckwheat, and sells considerable wood. The farm is a rough one, though productive; often produces premium crops of corn, oats, or potatoes; few improvements, as the purchase of the farm, the rearing of a large family, and the building of a new house, costing $3,000, in place of the homestead burned by accident a few years since, have consumed all surplus means.

Mr. R. J. Scovill has been farming about twenty-five years. Though the farm is by inheritance, an unfortunate manufacturing enterprise largely crippled his resources a few years since. The farm now embraces 300 acres; keeps twenty-five cows, three horses, two yoke of oxen, fourteen young cattle. Sends annually about 1,600 cans of milk to New York; raises most of his own coarse grains; has six acres of young orcharding just coming into bearing, and sells fruit to the amount of a few hundred dollars. Has expended largely in improvements in clearing land and draining; also in buildings, which are extensive and in good repair.

Mr. Franklin Reed began farming twenty years ago. Had $500 at that time. Bought farm on credit, which, by addition, is now 225 acres. Keeps sixteen cows, one yoke of oxen, two horses, eighty head of young cattle; raises all his own coarse grain; makes butter and cheese and fattens pork; makes 400 pounds of cheese per cow, and sells 1,200 pounds of butter; calves, vealed or raised:

400 pounds of cheese, at 11	$44 00
75 pounds of butter, at 35	26 25
Calf at	10 00
	80 25

or $80 per cow. The farm, though rough, is productive: barns and out-buildings are new, but Mr. Reed has preferred to lay up his money to investing in improvements. His books show $12,000 at interest, besides the farm and stock paid for, as the result of industry and economy.

I omit, for reasons before specified, the other two land-owners in the district. In some

respects this is an exceptional district; in others its counterpart may be found all over Connecticut. We are three miles from our railroad-station, West Cornwall, on the Housatonic Railroad, and sixty miles from Bridgeport, and one hundred and twenty from New York, where we find a market for our surplus products. Many parts of the State have better facilities for market, and adopt a different and sometimes more profitable system of husbandry. But our land is particularly adapted to grass, and the dairy seems to be still, as it always has been, the natural business for farmers on the hills of Litchfield County.

Mr. T. G. Kingsley, of New London, correspondent of the Department, reports concerning his county:

Gardening pays the best of any kind of crops in this county. Selling milk in the cities also pays well The soil in this county requires fertilizing to a considerable amount, or our crops are small, but by using phosphate, guano, fish guano, or plaster, the crop is increased from one-third to one-half per acre. Many of our farmers purchase western cattle in the spring of the year and sell them in the fall or winter for beef, and in that way are making money; selling the cattle for from 50 to 75 per cent. more than cost by keeping them from six to nine months. In one instance a man planted six acres of the Early-Rose potatoes and used 2,400 pounds of phosphate besides 100 loads of stable-manure, and he raised 300 bushels of marketable potatoes per acre, making 1,800 bushels. Some were sold for $1.50 per bushel; the balance, at $1. I know of a young man who purchased a farm for $7,500, and by attending to his business, using good judgment, energy, economy and prudence, in fourteen years sold sufficient from the farm to pay its cost.

CONCLUSIONS.

1. Farming in New England pays well if conducted with skill and enterprise, combined with the use of sufficient capital.

2. It is unremunerative to those who starve the soil, decline the use of improved implements and labor-saving processes, and fail to adapt their crops to soil, situation, and circumstances.

3. Those who employ the least possible labor, because of its high price, receive smaller net returns than those who use enough of it for good culture and large yields.

4. The popular estimate of the receipts of the farm is erroneous in failing to reckon house-rent, carriage-hire, and fruits and grains and vegetables used at home, and in assuming that a large portion of the gross receipts should be net savings, however small the annual expenditure of labor.

5. Proximity to numerous markets compensates for lower natural fertility; contiguity to the sea-coast renders available large supplies of cheap marine fertilizers, and the manufacturing villages furnish equivalent advantages to interior farms; and while the average yields of crops are thus made equal to those of the most fertile portion of the country, the prices obtained are greater.

6. The statistics of production show that for the labor employed no section of the country, excepting only three of the Middle States, enjoys a larger net return.

7. Lands are cheaper than in any equally populous and improved section of the country, with a probability of future increase in price, greater productiveness, the employment of a larger capital and more labor in their cultivation.

8. The necessity is indicated, before high prosperity can become general, for increased fertility, better drainage, more machine-labor and brain-work and less drudgery, and more feeding of farm-animals for flesh and milk and less for the bare support of animal existence.

CONDITION OF AGRICULTURE IN THE COTTON STATES.

By C. W. Howard, Kingston, Ga.

The condition of the agriculture of a country is to be determined by the salable value of its lands, the prices of its products, whether remunerative or the reverse, and the system of farming, whether ameliorating or exhaustive to the soil. The first two of these tests are sometimes variable and, therefore, not always accurate. War, with its immediate results, and panics in the money-market may affect injuriously both the value of lands and the prices of agricultural products. Allowances must be made for the effects of these causes; but the last test never varies or is inaccurate.

The agricultural condition of a country is never solidly prosperous in which a system of farming is practiced which exhausts the soil. This is destroying capital, for which destruction no temporary annual returns, however large, are an equivalent. The seeming prosperity based upon large results from a soil in course of impoverishment is always fallacious and, therefore, hurtful in the end.

We may arrive at the condition of agriculture in the cotton States by these tests. In ascertaining this condition, it is proper to say that the writer is most familiar with the State of Georgia. A large proportion of his remarks and estimates will be based upon his knowledge of this State. Georgia is generally considered to be the most prosperous of the cotton States. Any coloring which may unintentionally be given from this cause to southern agriculture will certainly not be to the disadvantage of the other States.

From North Carolina to Louisiana there is a strong uniformity in the physical structure of the soil, and in the character of the staple crops. There is also a decided uniformity in the system of agriculture which is pursued wherever cotton is raised. One State may, therefore, very well represent the rest of these cotton-States. The writer is a native of Georgia; his sympathies are with his brethren of the South, and, therefore, when he condemns existing practices it is with the temper with which an attached relative should point out the errors of a kinsman.

SALABLE VALUE OF LAND IN THE COTTON STATES.

It is proper to say that Texas is not included in this estimate among these States, because it is yet in progress of settlement. This examination will be confined to those of the cotton States which have been long and fully settled, and where land has attained a determinate value.

The value of land in the settled portion of the older cotton States is less than in any other country in Christendom. This was the case before the war. Take the State of Georgia, for instance, as a representative State.

In 1860, the average value of land was $4.85. The highest value of the richest county was $10.66 per acre. The lowest value was 68 cents per acre. If we contrast these values with those of the Northern, Middle, or the new Northwestern States, as Illinois, the difference is striking.

Since the war we might have supposed that the depression, in average value, would have been greatly increased; but this has not been the case to any great extent. In Georgia in 1866, immediately upon the close of the war, the average value of land was $3.42, showing a diminution from the value of 1860 of $1.43 per acre. There has been a slow advance in value from 1866 to the present time, the average value nearly, if not quite, reaching that of 1860. The lands of some sections have actually increased in value, in many instances to $50 per acre, while others have decreased from $20 to $30 per acre to from $3 to $5 per acre. The causes of this difference will be hereafter pointed out. The average value has, however, not materially changed. That which is true of Georgia, as to the value of her land, is true also of the other cotton States.

Why were these lands so low in price before the war? It was not the climate of these States, because while portions of the territory were sickly the larger portions were perfectly healthy. The sickly sections extended along the line of the coast, including the rice-lands and the level pine-lands, which were very difficult of drainage; but all the rolling lands of the interior, (including the greater bulk of the territory,) the mountainous portions, were extremely healthy.

It was not the poverty of the soil, because while a portion of this territory was poor the larger portion was originally very fertile land. With the same manure and the same culture, there is not an agricultural product of use to man, raised at the North, which cannot be raised in equal perfection at the South, independent of the products which are peculiar to the South, as cotton, rice, sugar, and the semi-tropical fruits. In fact the largest recorded yield, within the knowledge of the writer, of the cereals has occurred at the South, as 212 bushels of corn, 58 of wheat, and 100 of oats to the acre.

It was not the amount of taxation. The State tax in Georgia was about one-tenth of one per cent. This, perhaps, was a fair average of the other cotton-States.

It was not the amount of cheap land at the West, because those cheap lands were equally within reach of northern land-holders, and those lands did not sink in value on that account, by reason of emigration from them.

It was not slavery, because those lands were highest in value where most slave-labor was used. The rice-lands, for instance, requiring a hand to every 4½ acres, sold at from $150 to $300 per acre, while in the upper portions, where slave-labor was almost unknown, the lands would not command $5 per acre.

It was not because the farmers did not make money. They did accumulate under a most ruinous system of agriculture, because at the end of the year there were no wages to be paid, and if the crop covered expenses, their profit was large in the mere increase of their slaves.

What, then, was the cause of the low price of land? Clearly the bad system of farming. The value of the land was scarcely considered. It was cultivated in cotton and corn until it was unable to produce either, and was then thrown out to grow up in briers, sassafras, and scrub pines. A purchaser looking for land, if he found a field without a stump in it, considered that fact *prima facie* evidence that it was worn out.

Of course land, considered as something which was to become less valuable every year until it became worthless, was of little market value. There were some exceptions, as the rice-fields, where the annual

flooding or "warping" was an annual heavy manuring. These lands maintained their high valuation.

Since the war the same system of agriculture has been generally, but not universally, pursued. It is pleasant to observe an increasing departure from the old practice. Wherever this departure occurs, the lands are rising rapidly in value.

MARKET VALUE OF CROPS.

Cotton is considered almost exclusively the money-crop. It is almost the only crop which is sold. Planters, since the war, have, for the most part, bought their provisions with the proceeds of their cotton. The exceptions are the truck farmers, who supply the towns, &c., with a certain class of provisions. Besides these there are occasional instances of large farmers who not only make their own provisions, but have a surplus to sell. These men are almost always prosperous.

The question naturally arises, does cotton, with the present labor, pay the producer at present prices? The cost of raising a pound of cotton has been a mooted point. In order to settle it, the writer addressed letters to several of the most successful farmers in Georgia. But a small proportion of the parties addressed have returned replies. The letters of those who have replied are very valuable. These gentlemen are from different sections of the State, and are all gentlemen of experience, practical good sense, and successful farmers. One, Mr. Hardaway, resides in Thomas County, on the Florida line, while Colonel Winn's residence is near the northern border of cotton culture. Mr. Hardaway cultivates a very small farm, but does it perfectly. This gentleman took the premium on corn at the State fair, making 119 bushels of corn on an acre, while the average product of the State is 5½ bushels per acre.

Dr. Lavender is, perhaps, our best representative of successful mixed farming, raising clover, the grasses, live stock, and, among other things, 15 to 20 acres of turnips annually. At the same State fair he received the premium on turnips, having grown 1,550 bushels on an acre.

Mr. Dickson's name is a household word among southern cotton-planters. Upon anything relating to cotton, he is our highest authority. Before the war, this gentleman cultivated 1,000 acres in cotton, 800 in corn, and small grain in proportion, expending annually $10,000 for commercial fertilizers. His large experience, remarkable success, and his exact business habits give great weight to his opinions. The whole South will read his letter with surprise. His estimate of producing a pound of cotton being correct, (and it would require a hardy man to doubt it,) it follows that since the war, for the most of the time, the South has grown cotton at a positive and serious loss. The different estimates of cost, ranging from 11 cents to 17 cents per pound, may be easily accounted for. The lower estimates are based upon the practice of comparatively small farms with high manuring and under exceptionally skillful culture. They rather represent what may be done than what is generally done. Mr. Dickson bases his estimate upon the general practice of cotton-planters.

LEXINGTON, GA., *November* 9, 1874:

DEAR SIR: Yours of the 3d instant in hand, and contents noted. Having never experimented at all as to the cost of raising cotton, except in a general way, I am not prepared to give you an exact account of the money it would require to raise a pound of cotton. I have been a cotton-planter (and I might add a successful one) for forty-six years. I do not think we can afford to raise it at 12½ cents per pound, unless there is a material alteration in our present system of farming.

Yours, most respectfully,

Z. H. CLARK.

GRISWOLD, GA., *November* 7, 1874.

DEAR SIR: Yours of the 1st instant only came to hand yesterday, and, in compliance with your request, I give you my estimate of the cost of raising cotton with negro labor.

I have kept an account of the production on my small place, with the actual outlay, for several years, and have made estimates each year. The cheapest cotton I ever made cost about $9\frac{1}{2}$ cents and the highest about 12 cents. I think the average about $11\frac{3}{10}$.

My land is light, sandy loam, and with 180 to 200 pounds phosphate will average 200 pounds lint cotton. The only profit I get is from my corn, oats, fruit, potatoes, and grapes. I must make some cotton in order to get the seeds for my compost heap.

In the estimate above given, I have charged nothing for personal services; the remuneration comes from grain and seed for manure.

As ever, yours, truly,

E. C. GRIER.

LAWRENCEVILLE, GA., *November* 17, 1874.

DEAR SIR: Yours of the 3d instant, asking my opinion as to the cost of raising a pound of cotton, did not reach me until a day or two ago. I hasten to comply with your request, and will give you such ideas as I entertain with regard to the actual cost of producing a pound of cotton with free negro labor. I will give you the method by which I arrive at the cost, which will enable you to judge as to the correctness of my conclusion. I do not believe that we can arrive at any correct estimate of the cost of producing cotton as a general rule, as this depends greatly upon the favorableness or unfavorableness of the season, &c. To illustrate: a hand may cultivate ten acres in cotton and do it well, and from drought or early frost the crop be cut off one-half, while the cost will equal the production of twice as much, the difference being only in the gathering. My figures, though, I believe will be about an average in this locality. These are my opinions, given without having made any calculation or given the subject any very mature thought previously to receiving your letter. Others might arrive at different conclusions. The items of cost are: Hire of one hand and board, $175; interest on $100 worth of land, $7; wear and tear of land, $10; interest on horse worth $100, $7; cost of feeding horse, $50; one ton guano, $50; personal superintendence, $26; total expense, $325. Credited by 5 bales cotton weighing 500 pounds, 2,500 pounds. If 2,500 pounds cotton cost $325, one pound will cost 13 cents.

Yours, truly,

THOS. E. WINN.

THOMASVILLE, GA., *November* 7, 1874.

DEAR SIR: It gives me pleasure to promptly answer your question as to the cost per pound to raise cotton. I give you the cost for seven years, to wit: 1866, 14.50; 1867, 12.50; 1868, 12.25; 1869, 10.90; 1870, 8.60; 1871, 13.61; 1872, 10.77. The average is 11.88. This includes interest on value of land, repairs, interest on team, taxes, fertilizers, labor of cultivating, picking and packing, but nothing added for personal supervision. The latter would be hard to estimate. This year's crop has not been marketed, but will not exceed 10 cents. I keep a record of my crops annually, and it simply required the copying, as the calculation was already made and entered on my memorandum-book.

Respectfully,

R. H. HARDAWAY.

BARNESVILLE, GA., *November* 5, 1874.

DEAR SIR: In answer to your inquiries I will state that I have carefully counted the cost of making cotton from 1866 to 1874 each year. 1866, the cost per pound, $8\frac{3}{4}$ cents; 1867, $7\frac{1}{2}$; 1868, $9\frac{5}{8}$; 1869, $12\frac{1}{8}$; 1870, $13\frac{1}{2}$; 1871, $13\frac{7}{8}$; 1872, $14\frac{5}{8}$; 1873, $17\frac{1}{2}$; 1874, 14, or about that, as the cotton of 1874 is not yet all gathered; but I will not miss the figure by $\frac{1}{2}$ cent. The other accounts are from a diary kept of expenses and profits. I mean that includes all the costs; and all over the figures was clear profit, and all under clear loss to the producer. So you see that in 1873, when we got $13\frac{1}{2}$ cents per pound, my actual loss was 4 cents per pound, and in 1866, my actual profit was 20 cents per pound, as I sold for $28\frac{1}{2}$ cents. The great difference of cost from 1867 to 1873, $10\frac{1}{2}$ cents per pound, was caused by my inability to govern and control labor and make it effectual, the high price of labor, and the great demand for it, with the use of high-priced guano. This has no reference to any one else but my own farm.

I am, very truly, your obedient servant,

J. S. LAVENDER.

SPARTA, GA., *November* 15, 1874.

DEAR SIR: You ask me what it costs me to make cotton. At one time I could have told you its cost per pound; but what it costs to make it now depends on so many contingencies it cannot be estimated beforehand. I have sixty or seventy tenants, and it costs no two the

same to make cotton. It depends on the price of labor and its efficacy, direction of the sun and rain, time and quantity; worms, caterpillars, storms, frost, and land, as well as many other things. Crops vary from one bale to eight bales per hand.

There is one thing certain: When cotton is below 16 cents, the tenant and landlord, in four cases out of five, lose money. For example: Two hands, on an average, in Georgia, without manure, will make about 3 bales each, making 6 bales, planting 12 acres each in cotton, making 24 acres; 6 acres each in corn, making 12 acres; that is, per each mule, 36 acres. You may say this is low average, but it is high enough as Georgia now is.

6 bales cotton, 2,400 pounds lint, 16 cents		$384 00
6 bushels corn per acre on 12 acres, at $1 per bushel		72 00
Fodder		7 20
		463 20
Less rent of land		115 80
		347 40
1 mule and feed	$175 00	
Tools, machinery, and horses	20 00	
Hire of two hands	240 00	
Use of house, board, and wood	120 00	
	555 00	
Loss		207 60

You may say my estimate is too low. Then add to the product 33⅓ per cent., making $463,20: still a loss of $91.80. Add on 50 per cent., making 4½ bales per hand and 9 bushels corn, and amounting to $521.10; still a loss of $33.90.

Who will say a hand will make 4½ bales of cotton without manure and 54 bushels of corn, which is in the last estimate? I can see very plainly what causes so much loss and hard times. The planter furnishes every thing—houses, gardens, patches, and the best wood on his place, free of charge. The true plan is to pay for all you get, and get pay for all you let go. The planter furnishes house, wood, fruit, garden, and patches, for three persons, to get poor labor out of one—out of proper time, poor in quality, &c.

Very respectfully,

DAVID DICKSON.

In view of the statements contained in these letters, it cannot be said that for the last ten years the price of the great staple of the South has been remunerative. On the contrary, taking the average of cotton-planters throughout the South, has not the cotton-crop been produced and sold at a positive loss? The mere fact that this question is even debatable proves that, if there has been a general profit, it has been very small. It is worthy of notice that in none of these letters is there an allowance made for the personal supervision of the planter. A large portion of cotton-planters are educated men, who could command salaries in other pursuits. Their time is money, and its value should be included in the estimate of the cost of cotton-culture.

IMPROVEMENT OR DETERIORATION OF THE SOIL.

This point has been partially met in the foregoing remarks. A very large proportion of the cotton-lands of the South contains a material admixture of sand. In fact, a certain proportion of sand is indispensable to successful cotton-culture. Wherever such a soil is undulating, and is submitted year after year to shallow plowing, it must not only become poor by the surface being washed away, but hideous and deep gullies are formed. The writer, who has passed his three-score years, well remembers lands that were originally covered with wild-pea vines, luxuriant grasses, and magnificent forests which now, in their excoriated and gullied surface, are sad mementos of the wasteful improvidence of their owners.

Since the war there has indeed been a vast expenditure of money for the purchase of commercial fertilizers. Three or four years since the farmers of Georgia expended, according to the testimony of the state

inspector of fertilizers, $10,000,000 in one year for these fertilizers. These were not designed or expected to improve the land. They were homeopathic doses to increase a single crop. Under this system of exclusive cotton-culture, accompanied by shallow plowing and the use of commercial fertilizers merely to increase a single crop, the lands of the cotton States are growing annually poorer instead of richer. There are of course honorable and marked exceptions to this hurtful practice. The general usage, with the general result, has, however, been correctly stated. The traveler who passes through the cotton-belt of the southern states will be struck with the constant recurrence of worn and impoverished plantations, with here and there a pleasant exception.

Judging by the test given, it must be conceded that the agricultural condition of the cotton States is generally far from being prosperous. The value of the lands is low, the price of the staple crop is unremunerative, and the lands are in a course of impoverishment.

METHODS OF IMPROVEMENT.

The remedy for this low condition of southern agriculture is to be found in the abandonment of exclusive cotton-culture and the devotion of a much larger area to the growth of the cereals, the grasses, and the raising of live stock.

It is not designed to advocate the abandonment of cotton. This would be a supreme folly. In many respects this plant is the most beneficent boon of a kind Providence to man. No other plant is capable of so great a variety of uses. Its seed affords an excellent oil for the table, and for lubrication, or for conversion into soap. The meal left after the oil is expressed possesses greater flesh-forming properties for the domestic animals than any other food which can be given them, Indian corn not excepted. The seed in its natural state, or when converted into meal, has greater manurial value than any other single substance. This is strong language, but the analysis is given by one of our best analytical chemists. Prof. W. J. Land, of Atlanta, Ga., fully sustains it.

This analysis may be of interest to those persons who are not familiar with the cotton-plant:

Constituents of the ash of cotton-seed.

	Per cent.		Per cent.
Potash	35.440	Sulphuric acid	3.222
Soda	0.810	Oxide of iron, (and alumina,)	1.075
Magnesia	15.067	Chlorine	0.490
Lime	4.450	Carbonic acid	3.465
Phosphoric acid	30.016	Sand and charcoal	5.965
			100.

NOTE.—If we also assume that the *cotton-seed* will *average eight per cent. of moisture,* (including the small fraction of sand,) the proportion of *moist sandy seed* to the *ash, minus the carbonic* acid, would be approximately as 100 to 3.146, and the analysis of the ash as follows, viz:

ANALYSIS.

Ash of cotton-seed, minus the carbonic acid.

	Per cent.		Per cent.
Potash	36.712	Sulphuric acid	3.337
Soda	0.839	Oxide of iron, (and alumina,)	1.113
Magnesia	15.600	Chlorine	0.507
Lime	4.609	Sand and coal	6,190
Phosphoric acid	31.093		
			100.

It will be observed that more than 65 per cent. of the ash of cotton-seed is composed of potash and phosphoric acid. Practice sustains the correctness of the analysis. In Mr. Hardaway's crop of 119 bushels of corn on an acre of ordinary pine-land, the sole fertilizer used by him was 60 bushels of cotton-seed.

It is well known that the fiber of this plant supplies lines for the plow, cordage for ships, sails by which they are impelled, requires a large merchant-marine and countless railway-lines for its transportation, clothes a large proportion of mankind, and gives occupation literally to millions of human beings of both sexes and of all ages.

A country in which cotton is judiciously grown, and in which the various manufactures for which it affords the raw material are in successful operation, and which supplies the food for its own laborers, can support a more dense population than any other portion of the globe. Yet this invaluable blessing, like other misused blessings, may be converted into a scourge. Although capable of this vast utility, it may be questioned whether the cotton-plant has been of greater benefit or injury to the Cotton States. Few persons not living in these States can form an idea of the extent to which it has monopolized the attention of southern land-holders. For instance, the comptroller-general of the state of Georgia informs us that in 1873 there were produced in the state 504,253 bales of cotton, worth, at 15 cents per pound, $75 per bale, amounting to $37,818,975. Yet it cannot be doubted that its agricultural population, taken as a whole, were poorer at the end than at the beginning of the year. Little of the proceeds of the crop remained in the State, except that which was paid in money for labor; almost the whole was expended in fertilizers, bacon, corn, flour, mules, &c.

The population of Georgia, in round numbers, is 1,200,000. The crop of corn, in 1873, was 10,025,013 bushels; of wheat, 847,455 bushels; of oats, 1,553,003 bushels. The number of horses and mules was 171,223. Allowing 50 bushels of corn a year to the horse or mule, they would require at that rate 8,561,150 bushels. Deducting this amount from the whole corn-crop, it would leave for the support of the 1,200,000 people 1,463,863 bushels of corn for a year. This would be at the rate of less than 1.4 bushels of corn and about .7 of a bushel of wheat for the sustenance of each person, leaving nothing for the 794,527 hogs and 608,379 oxen and other cattle. There must have been at least 12,000,000 bushels of corn brought into the state during that year. This is about the condition of things throughout the cotton states. Can it be a matter of wonder that they are in a depressed condition? Every one who handles a cotton-bale prospers except the man who produces it. Three years ago the writer by careful estimate ascertained that $26,000,000 worth of the necessaries of a farmer passed over the Western and Atlantic Railroad from the West *via* Chattanooga to Atlanta, all of which could have been produced in Georgia. They consisted of horses, mules, hogs, cattle, sheep, corn, wheat, bacon, flour, &c. Can we wonder that the cotton-planter is poor and in debt? We see what becomes of the proceeds of the cotton-crop. The exclusive culture of cotton demoralizes the negroes.

In this connection it will not be improper that the writer, as a southern man, while he condemns the faults of the blacks, and they are very numerous and vexatious, should do justice to that which is praiseworthy in their character and conduct. During the war, while the men were in the army, our wives and children were at the mercy of our servants. Their conduct generally was beautiful. Never were they more orderly, subordinate, industrious, and respectful. The southern

people owe them a debt of gratitude, which they will repay, if they are left free to act. This, without question, is the general, not universal, feeling among former slaveholders. No sensible man would venture an assertion like this, in a way so public, without being assured of its correctness.

It was apprehended if the war terminated unfavorably to the south, that the scenes of Saint Domingo would be re-enacted among us. This apprehension was based upon the well-known fact that among ignorant persons, new-found liberty is often followed by a temporary intoxication leading to great excesses—to violence and bloodshed. These apprehensions were unfounded. There has been rarely violence, bloodshed, or excess, save in those instances in which they have been incited by crafty and bad white men of southern as well as northern origin. If there had been no wicked interference on the part of these men, the "enteinte cordiale" between the blacks and the whites by this time would have been nearly or wholly restored.

Exclusive cotton-culture demoralizes the blacks in this way: The labor on a cotton-plantation where a full crop is planted is without intermission, and it is excessive in the quantity required, often exceeding in cost in a single year the whole salable value of the plantation. For instance a plantation of 1,000 acres which could not be sold for more than $5,000, if 500 acres are planted in cotton would require thirty hands. These at $12 per month and rations, say, including both, would be $15 per month, or $180 per annum. The wages of thirty hands would amount to $5,400 per annum. Fifteen horses or mules would be required to plow these 500 acres. Allowing $100 as the annual cost of each horse or mule, including wear and tear, loss and food, the aggregate amount would be $1,500. Adding this to the cost of human labor, it gives the amount of $6,900 for labor on a plantation worth $5,000. This condition of things is anomalous and ruinous. To this should be added the fact that the average yield of cotton in Georgia, according to the sworn returns to the tax-receiver, is one bale to three and one-half acres.

Such is the demand for labor in those sections in which exclusive cotton-culture is practiced, that the planter is compelled to take any labor that offers, whether it be good, bad, or indifferent. The exclusive cotton-planter belongs practically to the negro, as the negro once belonged to him. He is at the mercy of the negro and the latter knows it. It is human nature, whether white or black, to presume upon such knowledge. The planter cannot demand a certificate of character, for he is only too glad to obtain the labor on any terms. If the laborer behaves badly and is discharged, he is indifferent to it, because he can get employment on the next plantation. This condition of things is eminently hurtful, both to the laborer and the employer.

If but half the usual quantity of cotton were planted, the value of the crop would be about the same, and but half the labor would be required. From this surplus the planter could make selections, employing the industrious and rejecting the idle and worthless. He could demand certificates of character as is usual in other countries in the employment of servants. This would make character valuable among the blacks, as without it they could not obtain work. So long as the laborer thinks he is conferring a favor on the person who employs him, so long his position is not dependent on his good conduct, so long will he be insubordinate, unreliable, and his employer will suffer. The interest of the planter and a due regard to the improvement of the laborer, require the reduction of the cotton area one-half.

While pointing out this great defect in our labor system, it is not designed to advocate any change except the improvement of the labor we now employ. The attempt to introduce hired white men from any quarter to carry out the exclusive cotton system is, from various causes, preposterous.

In the southern climate, with the habits of the people and the wages they can afford to pay, no laborer can be a substitute for the negro. He, as such, may and must be improved. A prominent method of this improvement has been pointed out, viz, by creating competition and thus giving value to character.

The cotton states do greatly need skilled white labor in the dairy, the orchard, the vineyard, the mine, the manufactory, and the trades. If a judicious system of farming were adopted, such as is practiced at the North and in Europe, in which the amount of plowed crops bears but a small proportion to the land in the cereals, meadow, and pasture, the present farm-labor of the South in number is abundant.

If they would improve their farm-labor, planters must live on their own estates. Absenteeism must be abandoned. Formerly, it was the practice of many planters to live in the towns and cities, while their plantations, managed by overseers, were perhaps hundreds of miles distant. A large number of Georgians and South Carolinians planted in Mississippi and Arkansas, visiting their plantations for a short time once a year. A few are now pursuing the same practice. Large numbers still carry on plantations at a less distance in the state in which they live. This habit was always injurious, but is now ruinous; and with the present labor, a man who cannot or will not live on his own farm would be wise to sell it even for a song or give it away.

The planter must not only live on his own plantation, but he must attend to every detail of its management. He cannot now afford to employ an overseer. And if he would have his work pressed with successful vigor, he must be willing when it is necessary to pull off his coat and "take a hand" himself.

The planter must require his sons to labor at least a part of the year, for two reasons: one, that it may be instilled into his mind in early life that honest labor is never beneath the dignity of a gentleman's son; the other, that he may be able when he farms on his own account to judge of work, as to the time it requires, and its perfection when completed. This partial labor is not inconsistent with the highest form of solid and even elegant education. Instances of this compatibility will readily occur to the mind, from Mr. Clay and Mr. Webster downward.

While the planter is troubled with defective labor in his field, the ladies of his household are no less troubled in regard to female household-servants. As a general rule, the negro women are more averse to work than the men. The planter's wife, like her husband, is compelled to take any labor which offers. She must therefore often employ women-servants whom she knows to be thievish, lazy, and dirty in their habits. Unfortunately, from our own habits, which, before the war, were almost nomadic, country-houses were badly supplied with modern comforts and conveniences. Indeed, they were not necessary, as it was often troublesome to find employment for the negro women and children. It is rare to find in a planter's homestead a cellar, woodshed, cistern, sinks, or water in the rooms. These conveniences cost comparatively little, and they would greatly diminish the necessary number of female house-servants. If the planter be just to his family, he will supply them. Whenever the supply of female servants exceeds the demand, as in the case of the negro men, certificates of good conduct may be required, and character among the women will become valuable to them.

The writer has devoted anxious and prolonged thought to the solution of the labor-question at the South. In the cotton states, we can use in farm and household work no other servant than the negro. He was placed here, not by us, but by persons in other states and from other countries, who derived the profit of his importation. We cannot remove him if we would, and we would not remove him if we could. Though, as a general rule, with some, and it might be said, with numerous exceptions, he is thievish, indolent, unreliable, improvident, and without regard to contracts, still he is very capable. As he cannot be removed, he must be improved. The attempts at this improvement thus far have been mere surface-efforts. No attempts at intimidation, no forms of contract, no combinations among planters, no penalties of the law, can effect this improvement. It must include the whole present system of southern agriculture. It will require such changes in our mode of farming as will enable us to accomplish our ends with less than one-half of the labor which we at present employ. The negro must be made to feel that in order to eat he must work, and that in order to obtain work he must be honest and industrious. The landholders have it in their power to accomplish this result by requiring on their farms less labor, and in their selection employing laborers only of good character. Self-interest and humanity both require this change.

The change referred to, including both our farm-system and the habits of the negro, must be slowly effected. A complete immediate result is, in the nature of things, impossible. No political revolution, no change from a monarchy to a republic or the reverse, no downfall or elevation of dynasties with the wars precedent to or consequent thereon, ever so universally affected the people among whom they occurred as the abolition of slavery has affected the people of the South. In addition to the privations, losses, and bloodshed of war, it has affected our social, moral, educational, economical, and political relations. The ill effects of merely political revolutions can be removed only by time. They must wear away or gradually yield to more potent influences. A limb that is suddenly fractured can be restored to use only by a protracted cure. If hastily set, permanent deformity may, and probably will, be the result. Slavery was so interlaced through the southern body-politic that we cannot expect that the laceration caused by violently tearing it out by the roots can be suddenly healed. But that which cannot be hastily, may be slowly and certainly, accomplished. With the changes proposed in our farming-system, and with their ameliorating effect on the negro, we might confidently expect a condition of things in which the southern planter will be more prosperous than he ever has been.

Intensive farming or high farming, meaning the cultivation with the plow of those acres only which can be heavily manured, lies at the basis of improvement, because by it we obtain the greatest results with diminished labor. The cost is rather in the manure than in the cultivation. Recent instances have proved that the soil and climate of the cotton states can produce the largest results and the greatest profits, from high culture. Last year, Mr. T. C. Warthen, of Washington County, Georgia, produced five bales of cotton, 500 pounds each, from a single acre of land. At 15 cents per pound, this would give $375, besides the cotton-seed, from one acre. Notwithstanding this large product the possibilities of an acre of land in cotton have not yet been reached. The same year the average product throughout the state was one bale from three and a half acres. Under the ordinary average mode of cultivation, it would have required 16½ acres to have produced as much as Mr. Warth-

en's acre. Reference has already been made to Mr. Hardaway's product of 119 bushels of corn from one acre.

This year, 1874, at the Georgia State fair, some remarkable results of high farming were exhibited. One exhibitor produced 97 bushels of corn, 21 bushels of pease, 2,100 pounds of fodder, and 1,000 pounds of pea-vine hay from one acre of upland. His net profits on the acre were $183.25. Another, Mr. J. J. Parker, of Thomasville, 694¼ gallons of sirup from an acre of sugar-cane, leaving a net profit of $443. The only manure used by him was 60 bushels of cotton-seed, costing $6.

The society offered a premium for the best results from a one-horse farm. The successful competitor was Mr. J. S. Boynton, of Calhoun County, who made products which sold for $2,940.33. The expense of his farm was $449, leaving a net profit of $2,491.33.

A premium was also offered for the best support of a family of eight persons from the smallest number of acres. This premium was won by Mr. J. Cox, of Greene County. His family consisted of eight persons. On four acres his product was as follows:

By yield of 4 acres of corn, 75 bushels per acre, 300 bushels, at $1	$300
8,000 pounds shucks, at 50 cents per hundred-weight	40
4,000 pounds fodder, at $1 per hundred-weight	40
6,000 pounds pea-vine hay, at $1 per hundred-weight	60
75 bushels sweet-potatoes	37
three beeves	36
three sheep	6
ten hogs	75
chickens, eggs, butter, &c., sold	50
Aggregate sold	644

This does not include vegetables, chickens, eggs, butter, milk, &c., consumed by the family. No help was hired. The expense of cultivation, including manure, was $24 per acre, leaving $548 net profits. An additional acre was planted in vegetables. The stock kept was 3 milch-cows, 14 of other cattle, 2 horses, and 27 hogs. These animals must of course have had outside pasture. Thus five acres of land were found sufficient to give a comfortable support to a family of eight persons.

Such instances might be greatly multiplied. Those which have been cited throughout this paper show conclusively that "high farming" is remunerative in the cotton States, with the triple effect of improving the soil, increasing profits, and diminishing, and therefore controlling and improving, labor.

But the southern landholders will say, "If we are to cultivate with the plow only the small proportion of our land which we can manure heavily, what is to become of the rest of it? Is it to remain idle?" Certainly not. The rest may be devoted to the small grains, to meadow and pasture.

We may learn a valuable lesson from the English practice. By an official agricultural report of the United Kingdom of Great Britain and Ireland we learn that the proportion of land per hundred acres devoted to culture was divided as follows. Out of every one hundred acres there were in—

	Acres.
Green crops, including beans and pease	25.4
Roots or green crops	11.3
Bare fallow	1.2
Clover or grass under rotation	13.4
Permanent pasture	48.7
	100.00

These lands are very valuable, ranging in price from $300 to $500, and sometimes a higher sum, per acre. The interest on the cost of one acre there would buy several acres in some portions of the cotton-growing region. By what system have they made their lands so valuable, and how do they maintain the value? The answer is given in a nutshell in the above figures.

It will be observed that out of 100 acres, but 11.3 are in crops which require the use of the plow or hoe. The rest, with the exception of pease and beans, are either in small grain, meadow, or pasture; nearly one-half in pasture; twenty head of cattle and 67.3 sheep to the hundred acres. These cattle and sheep are not our diminutive stock, but the huge, fat animals which are furnished to the English butcher. To the manure of these animals, scrupulously saved, may be annually added $50,000,000 worth of commercial fertilizers. Under this system, it is no wonder that the older an English acre is the better it becomes. The buyer does not look for stumps to determine whether the land offered him is or is not exhausted.

It is easy to imagine a cotton-planter, with his hundreds of acres in cotton and corn, reading these statistics, and sneering as he reads about turnip-patches, pease, beans, and grass. He is welcome to his sneer. But there is one thing certain, the man who adopts the general system of farming indicated by these statistics will not be harassed at Christmas in paying off a large gang of laborers; there will be no mortgage on his farm, nor will the dread of the sheriff haunt him; the clutches of the factor will not be upon him; bank-protests will not humble him; he will not lose his self-respect by cringing or dodging to avoid payment of a debt for fertilizers; and his land will be better at the end of the year than at the beginning.

But the cotton-planter is in debt, and he thinks that he must plant a large cotton-crop to pay his debt. The motive is honorable, but the reason is delusive. Every year since the war it has been hoped that, though the present season and prices are unfavorable, the next will be better. The expectation has proved a delusion and a snare. As a general rule, the cotton-planters are more in debt now than during the first year after the war. Sad experience has proved that exclusive cotton-planting does not pay debts; it creates or increases them. A man may be cotton-poor as well as land-poor. A gin-house full of cotton may represent a bankrupt, if it cost him more than it will bring in market. With a large field of observation, and a habit of using opportunity, the writer cannot recall a single instance of a man who has planted cotton exclusively since the war and has made money. He can recall many who have made money who have practiced a mixed husbandry, in which the proportion of cotton planted was comparatively small.

If a planter is so deeply in debt that he must rely on the throw of the dice to save him—in other words, the uncertainty of the rise of cotton—it would be best for him to surrender his effects, and begin again under a wiser system. It is often best when we cannot untie a knot to cut it; it is always best when the knot gets tighter by efforts to untie it.

If he be only so far in debt that he can free himself by the sacrifice of a portion of his land, it would be wise in him to make the sacrifice, rather than make matters worse by pursuing his present ruinous system

If he has been so fortunate as to escape debt thus far, he will be prudent if he makes that escape certain in the future by adopting a system by which he has something over expenses to sell, and nothing to buy which his farm will produce.

There are, however, alleged difficulties in the proposed change in southern agriculture. It is said that we cannot grow the artificial grasses common in England and at the North, and that therefore we cannot raise hay and live stock to advantage.

Suppose the objection is well-founded, and that the South cannot raise clover and the artificial grasses, let us look at the natural or indigenous substitutes for them common throughout the South.

For grazing, the common old-field broom-sedge is well adapted, if kept constantly and closely fed down. If it is suffered to run up, it forms its hard seed-stem, cattle refuse to eat it, and it becomes the wretched eye-sore which disfigures thousands of old plantations throughout the South. Among all these waste places there is not an acre of broom-sedge that will not put more than one dollar's worth of flesh on a calf, colt, or on several sheep. If it does this, that acre is paying 10 per cent. interest on $10. Are there any stocks or bonds which pay a better interest than this? The broom-sedge acre has this advantage, it cannot be burned up or washed away, neither can it be stolen, embezzled, nor can it run away. That property is not idle which pays 10 per cent. interest.

In large portions of the South the range is excellent. No pasturage of whatever kind is better than that of a good range for three months of the year. After July, the woods-grass becomes tough, and, while it will keep dry cattle in good order, is not sufficient for milch-cows and horses. After July, the crab-grass of the stubble-fields is ready for live stock of all kinds, and nothing can give better grazing from that time until it is killed by frost.

Bermuda-grass, although originally an exotic, may with propriety be classed as a native, as it spreads without sowing or transplanting. This grass has been the terror of exclusive cotton-planters on account of the difficulty of eradicating it. Dire threats have been made by this class of persons against any one who should introduce it into their neighborhood. They declare that it can swim over or crawl under a water-course. Yet it cannot with reason be doubted that this grass, in connection with sheep, is to be the salvation of the worn regions of the cotton-belt. It will grow in any soil, wet or dry, upland or lowland, sand or clay, but thriving in proportion to the fertility of the soil. Wishing to have incorporated in this paper, the opinion of a very sensible and successful cotton-planter of large views, Col. A. J. Lane, of Macon, Ga., in regard to the merits or demerits of Bermuda-grass, the writer addressed him the following inquiries: What is the best method of destroying it? What is its value for grazing and hay? What is its manurial value? His opinions, and they are entitled to grave consideration, are found in the following extracts from his reply:

HOLLY BLUFF, NEAR MACON, GA., *November*, 1874.

DEAR SIR: I avail myself of this the first opportunity to comply with your request that I would give you my views upon Bermuda-grass. You ask my answer to the following questions, viz: What is the best method of destroying it? How many seasons does it require to destroy it? What do you consider its manurial value? What its value for grazing and for how much of the year? Have you ever made hay of it?

I answer your questions as propounded, as best I can, together with such comments and suggestions as my time will permit, and which, I hope, may prove of some value.

Upon our ordinary upland I have found no difficulty in destroying it by close cultivation in cotton two years in succession. It requires a few extra plowings to get the sod thoroughly broken to pieces. The breaking should be done with a small plow first, and a harrow run through it once or twice, all in winter or early spring months. The land prepared and cultivated in the usual way, take advantage of the dry, hot months of summer to have the grass that may be found alive plowed and hoed up, and exposed as much to the sun as possible. With the ordinary seasons so much of the grass will be found killed the first year that but little interference to even the second crop need be apprehended. Pea-vines, or any crop that

will thoroughly shade the land, will destroy it when not pastured upon. Broom-sedge and briars soon run it out. Upon low lands, where there is much moisture, its destruction is impracticable and would not compensate the labor required. I think it very doubtful whether there is an acre of land thoroughly set in Bermuda-grass in the South, (if the proper use was made of it) that is not worth more than any other crop that can be grown upon it. If I am correct in this broad opinion, our efforts and advice should not be as to how to kill it, but should rather be as to how to propagate it, and try by all the arguments possible to induce our planters to enter more generally into its cultivation. We should not concern ourselves about how to exterminate it, but let it grow and spread, and encourage it to take hold, and the more land becomes covered with it the better. I am myself planting it every year upon such land as does not pay for cultivation, and how much such land is there in Middle Georgia, South Carolina, and portions of Alabama, and other of the cotton States. In speaking of the great value of this grass I mention as lands best adapted to its use, and lands upon which it can be grown profitably, the old counties of Middle Georgia, and upon lands of a similar character wherever found in the cotton States.

As to its value for grazing and how much of the year. In answering this inquiry I cannot better illustrate than by a fact that came under my own observation and which first directed my attention to the great value of Bermuda-grass. Nearly thirty years ago I purchased an old plantation adjoining my place, in Hancock County, and for which I paid about $10 per acre. Other lands adjoining this place, and no better, were then worth twice or three times this price. The reason of the decreased value of the land was on account of its having too much Bermuda-grass on it. Upon the place was an inclosure of about thirty acres. The dwelling and out-houses were in this inclosure, and in which was a fine spring and constant running branch. Having no use for the dwelling-house, and wishing to preserve it, I permitted a man to occupy it, and gave him the use of the inclosure of thirty acres, which was very thoroughly set in Bermuda-grass, and as much land as he could cultivate on the balance of the farm. The stock in trade of this man was a wife, a cow and calf, sow and pigs, and a very good brood mare, together with about one dozen worthless dogs. He cultivated a little crop of corn, but never made enough to feed his wife and dogs, relying entirely upon the Bermuda-grass for the subsistence of the stock, and upon which they subsisted, and entirely within the inclosure of thirty acres, except a few months in the winter when they had access to the balance of the plantation. He remained upon this place five or six years, when the house accidentally took fire and burned up. He never during the time purchased a horse, cow, or hog. The burning of his house made it necessary for him to move, and I tried to purchase his surplus stock, which consisted of about 25 head of cattle, 75 head of hogs, and 5 horses. The cattle were the finest in the neighborhood, and the hogs and the horses compared favorably with any others. I offered him for his increase $1,000, which he refused. So much, then, for the grazing properties, and some estimate of its value may be deduced from the facts of this man's success. With reference to the manurial advantages of Bermuda-grass, I cannot better answer you than to give you the result of four crops grown upon this thirty acres of Bermuda-grass. Having gotten rid of my tenant and his dogs, and the place being inaccessible for pasture, I determined to bring it into cultivation, and, without going into particulars as to cultivation, I give the result of the four first crops, which were made without any manure, except the corn, which had the same manuring with cotton-seed as the balance of the land.

First crop cotton, upon which we did not get much if anything more than a half stand, owing to the immense quantity of grass-sod. In the measurement of these crops one acre, of not more than an average was selected, product: First crop, 1,800 pounds seed-cotton; second crop, 2,800 pounds seed-cotton; third crop, corn, 65 bushels per acre; fourth crop, wheat, 42 bushels per acre. The average product of this land would have been originally not more than 1,000 pounds seed-cotton, 15 to 20 bushels corn, 8 or 10 bushels wheat. The same land is still in cultivation, and the finest crops grown in Hancock, I have no doubt, are now made upon it. I know of no crop that improves land more, and certainly none that will at the same time give such income.

Why is it that the blue-grass lands of Kentucky are so valuable, being worth from $50 to $150 per acre? The answer is that they afford a handsome income without labor.

What blue-grass is to Kentucky, Bermuda-grass is or should be to Georgia and the South generally. I have never made hay from it, and have never considered it a valuable grass for that purpose. It is a well-known fact, however, that it does make hay of a fine quality.

A gentleman of this county informed me a few weeks since that he had just cut, from one acre, eight large two-horse wagon loads of the finest hay that he had ever seen. This was upon very rich bottom-land on the Ocmulgee River, a few miles below Macon.

Respectfully, yours,

A. J. LANE.

The writer has had no personal experience with this grass, as his attempts to introduce it into Northwestern Georgia, a blue-limestone region, have been unsuccessful, yet for more than thirty years he has attentively

observed its habits and its effects upon land, and from this observation he is fully prepared to indorse the estimate of Colonel Lane. There is no grass in Europe, or at the North, which will afford more or better grazing for as long a portion of the year, and few, if any, which on very rich land will yield more or better hay.

So much for spring and fall grazing. For winter the Terrel grass or wild rye, (an *Elymus*) affords excellent grazing for horses, cattle, and sheep, not for hogs, which reject it. This grass is native in all the cotton States from the mountains to the seaboard. It succeeds on all varieties of soil, the only requirement being that it should be rich. In large portions of the cotton states, especially in the pine-lands, the winter range is so abundant that cattle and sheep are never fed.

Those planters who are sufficiently fortunate to own cane-brakes have an inexhaustible source of winter food for cattle.

For hay purposes, crab, crowfoot, Bermuda, and gamma grasses are sufficient. With the exception of Bermuda, they are not equal in nutritious value to clover, timothy, &c.; still, a larger allowance will feed and fatten stock well. It is not necessary, therefore, for the cotton-planter, who wishes to change his system, to wait for the introduction of foreign grasses. He can begin at once and with the necessary elements of success ready at his hands.

But it is not true that artificial forage, plants, and grasses will not flourish at the South. They will not thrive on very sandy land or poor land of any kind; but where the soil has a substratum of good clay, and where it is naturally or artificially rich, and proper seasons for sowing are adopted, and proper precautions taken afterward, and the soil in proper tilth, the uncertainty of success is not greater than with a crop of cotton, corn, wheat, or oats. It is true that the hot summers are against them, but not more than the intense cold of the northern winter. Proper care will ordinarily obviate the bad effect of the summer's sun; that care is not to allow these grasses to be grazed during the summer, allowing the grass to fall and cover the roots from the sun's rays. Even with this loss of June, July, and August, the period of grazing is longer at the South than at the North, because it includes the whole of the spring, autumn, and winter. Lucern, red and white clover, orchard, timothy, herds, or red-top, tall meadow-oats, Italian rye-grass, and blue-grass will all grow on soils suitable for them. This is not mere theory; the practical proof is found in every one of the cotton states.

But the cotton-planter objects that he has attempted and seen others attempt the cultivation of these grasses, and that both he and they have failed; so they have failed, perhaps, for successive years with cotton, and yet they continue to plant it. One or several failures do not discourage them. The fact is, that the whole subject of grass-culture is so new to them, it is so foreign to their practice, which has been to kill grass, that it is no wonder that they make mistakes; by reading and inquiry they should learn how to correct these mistakes, and persevere until success has crowned their efforts; others, who once thought as they do, have persevered, and now they are the pleased owners of meadows and pastures.

One plant, in this connection, deserves the especial attention of the southern planter; that plant is lucern, the alfalfa of Chili and California. Lucern is a child of the sun, suffering less from heat and drought than, perhaps, any other forage-plant. Its tap-root, which becomes in three or four years as large as a medium-sized carrot, penetrates a number of feet in the ground and pumps up moisture and nu-

triment from below. Its requirements are very rich, clean, and dry land. These requirements being filled, it will, after the first year, yield from three to six, and even eight tons of hay, preferred by horses, cattle, and sheep to any other hay whatever. It will thrive from Texas to Virginia. It is the great reliance of the Swiss and French farmers. It will not succeed in England, as there is not sufficient sun; neither does it succeed at the North, because it is too cold in winter. It should be the main reliance of the southern farmer for soiling and hay.

It is not the purpose of the writer to enter fully into the discussion of grass-culture at the South, but rather to provoke thought and inquiry. Enough has been said to show that the planter need not fear to combine the making of hay or the rearing of live stock with cotton-growing from a deficiency in the material for both hay and pasturage.

In portions of the South the planters will not attempt to raise farm-animals, because in those sections the negroes will kill them. That this wanton destruction of cattle, sheep, and hogs by the negroes occurs cannot be denied; and under the present system of exclusive cotton-culture the difficulties of preventing it are much increased. This point is well made in a letter from a gentleman from Houston County, in Georgia, a county having the largest negro population in the State:

> We have excellent pasturage, both summer and winter, for stock, but it does us very little good. When the war ended we had on this place nearly four hundred hogs and only one dog. In a little over one year there were on the place twenty-three dogs and four hogs. We had also one hundred and seventy-five head of good cattle; now we can count all we have on our fingers. We have good fruit, and plenty of it, but we barely get enough for our own use. If we push the negro off our place our neighbor will be glad to take him: and then he will raid on us more than if we had him at home. If we succeed in getting one convicted of a misdemeanor, some sympathizing neighbor, who has cotton to chop or pick, is delighted to go on the bond to keep him from the chain-gang. Since 1867 we have paid in Macon more than $30,000 for meat and bread and other supplies for free negroes. All of it ought to have been produced at home, but under the circumstances it was impossible.

This is not a solitary case; there are thousands of cotton-planters in the same condition. This is a sad state of things. The evil is great, but it is corrigible.

Exclusive cotton-planting gives no time for any other farm-work or farm-interest. Not only is there no manuring, except by commercial fertilizers, which can be bought on a credit and rapidly applied, but the live stock necessary for manure have received little or almost no attention. Hogs, cattle, and sheep are rather an incident of the farm-work than a serious part of it. They are turned into the range and seen but rarely by the owner. The hogs have a little corn thrown to them to keep them gentle once a week. Sheep and cattle are salted once a week. This is all the attention they receive in summer and in many sections also in winter. Away from the eye of the owner, perhaps in a thick forest or swamp, it is hardly matter of surprise that a lazy negro, restrained by no principle or fear of law, should use his gun upon them as the most profitable kind of game. It is much easier to obtain meat in this way than to work for it. There is, besides, attached to it the charm of hunting.

With our labor which makes corn expensive we cannot raise hogs for market; but every planter should raise enough pork to supply his own family and his farm-laborers. Before the war it was to the interest of the planter that his slaves should eat as little as was consistent with vigorous health; now, it is the interest of the planter who conducts his plantation on proper principles that his laborers should eat as much as possible, because they give him a home-market for his provisions.

He can afford to sell to them at less rates than current prices in the town or village, as there is no expense of carriage.

Our ordinary method of raising hogs, letting them run in the woods until they are two years old, and then putting them up to fatten, is very expensive. After they are put in the pen, they require usually ten bushels of corn to fatten them, besides the other food which they have previously destroyed. An additional and serious item of previous cost arises from the sagacity with which woods hogs ascertain all holes and rotten rails in the planter's fences, and by which they are enabled to maraud upon the growing crops. The same ten bushels of corn, if fed to a pig confined in a pen or lot near the dwelling, would make the same amount of pork in one year as is made in the ordinary way in two years. If the pen or lot is well littered, although the cost of the pork might be even a little greater than the market-price, the manure will give a moderate profit. It is a good deal cheaper to obtain manure from our own farm-pens than from the Chincha Islands. If hogs are raised in this way, which on the whole is the cheapest way, he must be a very sleepy-headed planter who cannot protect them when they are within gunshot of his house.

No man in the cotton-belt should attempt seriously to raise either sheep or cattle without a shepherd or herdsman, whose time is either fully or partially devoted to them, as necessity may require. A few sheep, generally, at the South are a nuisance. They are enough to make the planter lose his temper if the negro or the negroe's dog kills them, but not enough to repay him in either wool or mutton. If a flock of sheep or a drove of cattle are turned out in the morning under the care of a trusty man with a gun and a good dog, and are brought up at night and penned, there will be little danger of depredation. If necessary, and the flock or herd be large enough to warrant it, a night-watchman could be employed. This employment of night shepherds is no novelty. The negroes of the South can hardly be more predatory than the wolves of Palestine. Watching sheep by night is connected with the grand event of Christianity. We can all recall the verses we learned in childhood—

"While shepherds watched their flocks by night," &c.

If the rearing of sheep and cattle be made a part of the business of the plantation, as much as cotton in a mixed system of husbandry, the accumulation of manure in well-littered folds or pens will be found to be more than an ample equivalent for the cost of attendance necessary to their protection.

The pilfering habits of the negroes in those sections in which the negroes preponderate, while they increase the trouble and expense of live-stock raising, are not a sufficient obstacle to prevent its successful pursuit. Making full allowance for this drawback, still it does not equal the expense of caring for stock during a northern or western winter.

There are few countries on the globe affording greater facilities for the lucrative rearing of sheep and cattle than a very large portion of the cotton States. The winters in those portions are so mild that no shelters are necessary, unless it may be a pine thicket in a very stormy night. At the North the same animals must be sheltered in barns often costing more than the price of a respectable southern plantation. They require no winter feeding, the winter grasses of the range furnishing them fair food. But neither sheep nor cattle can be fattened sufficiently in this way for a city market, yet they are placed even in February and March in a condition so thriving that the fattening process is easily and speedily completed.

In those more densely settled regions of the South in which there is no range, orchard, meadow, and blue grass, and, in mild winters, red and white clover, are green during the whole winter. If pastures set in these grasses are shut up in August and not opened until January, they will carry one medium-sized ox or eight merino sheep per acre until the natural pastures are green. At this date—November 20—on this farm, red clover which has not been pastured is in blossom, and orchard, meadow, oat, and blue grass pastures are as green as in the spring, affording full bite to horses, cattle, and sheep. This is in latitude 34°.

The ability to graze live stock during the whole winter is a singular advantage of the South, which has not been appreciated by the southern people. It is quite time that they should avail themselves largely of it by increasing their flocks and herds. This feature of the climate enables the southern wool-grower to adopt the English practice of folding sheep upon turnips. This cannot be adopted at the North on account of the turnips freezing in the ground. As folding sheep is unknown to the majority of southern readers, some remarks upon it may be of use.

After the turnips are matured—say in December or January—a fold is made, inclosing as many turnips as the flock of sheep will eat in twenty-four hours. One thousand sheep will consume the turnips on an acre in that time. One hundred, a tenth of an acre in the same time.

In making this fold, in the absence of hurdles a portable fence can be used. All the patent fences which have come under the observation of the writer are liable to be blown down in heavy wind. One is in use on this farm which an unruly ox cannot overthrow, nor can it be blown down. It is not patented. Take a panel of fence ten feet long made of pine planks six inches wide, with a small upright at each end, to which the planks are nailed. Near each end of the upper plank bore a two-inch auger-hole diagonally. Insert loosely into each of these holes a stake with a shoulder. A common sapling will answer. The planks will rest upon these stakes, and will stand at an angle of about 45° from the ground. One man can move and set these panels without difficulty. The planks of the corner panels should be gradually shortened from top to bottom to make them fit. This fence may be made dog or even wolf proof by using upright pointed slats instead of horizontal planks. No animal will attempt to jump such a fence, for fear of being impaled.

The advantage of folding turnips is twofold. It is by far the cheapest method of manuring land. No hauling manure is required, as the sheep haul their own manure, both solid and liquid, to precisely the spot on which it is desired to apply it. It is evenly spread without labor, no part being excessively manured at the expense of another part. The effect of this manuring will be felt for years. Land so manured is good for two bags of cotton to the acre the following year. The other advantage is the fine condition into which the sheep are put at a season of the year when mutton brings the highest price. When land is put into sufficiently good order to bring 500 bushels of turnips to the acre, the gain in mutton is an equivalent for the cost of the crop. The heavy manuring of the land is then clear gain.

The practice on this farm is, immediately after the oat or wheat crop is saved, to turn under the stubble, harrow and roll. The land is laid off in rows 2½ feet apart. The manure, either home-made or super-phosphate, is applied in the drill, and the seed sown by a drill. After the plants are in the third or rough leaf they are thinned, and then hoed and plowed once. The cost per acre, including manure, is about $20.

It is objected by some persons that the turnip is composed of nine-

tenths water. If so, it must be a very different water from that which we are in the habit of drinking. The turnip does not contain more water than green clover, yet every one knows the fattening properties of clover. He who thinks there is no nutriment in a turnip has certainly never eaten English turnip-fed fat mutton or beef.

This folding process is earnestly recommended to the attention of southern farmers generally, and especially to those living on the sandy lands on the coast. These lands are favorable in texture to the turnip, and are not poached by treading, as is the case with clay lands in wet weather. After one well-conducted experiment, it will not be necessary to urge a repetition of this folding process.

It is objected that wool degenerates in warm climates and becomes coarse and valueless. This is an error. Fur becomes coarse, but not wool. The writer, whose flock is of the Cockrill-merinos, which took the premium at the World's Fair in London, many years ago, the sheep being raised in Mississippi, after this lapse of time is now ready to compete with any wool in the United States for fineness of staple.

It is further objected that both mutton and beef are now so cheap that, if large landholders entered seriously into the raising of sheep and cattle, they would become valueless. Beef and mutton are very cheap at the South in the autumn. Sheep and cattle are not fit for the butcher at the South in the winter and early spring. At those seasons fat beef and mutton command very high prices. It is then brought from the West by drovers, who return home with their pockets well filled. Few southern planters ever fatten an ox or a wether; they, therefore, receive only the low prices of grass-fed stock. Twenty years ago a general attention to fattening live stock at the South would have glutted the market. Now, railroads have brought the South into close proximity to the great northern cities, and the market cannot be glutted. The South has great and peculiar advantages for fattening cattle and sheep in the turnip, pea-vine cut and cured when the peas are partially ripe, and the sweet potato. It is generally estimated that two to three bushels of sweet potatoes are equal in value to one bushel of corn. More than three times as many bushels of sweet potatoes can be raised on an acre as can be raised of corn in the most fertile lands in the West. In soils adapted to the sweet potato, and that is those that are rich and have a full proportion of sand, sheep and cattle can be fattened more cheaply than on the richest lands of the Northwest. Where sweet potatoes are dug from a sandy soil and in dry weather they need no washing. By the use of a root-slicer, worked either by hand or horse power, they can be prepared for consumption with hardly an appreciable cost. Well-cured pea-vines and sweet potatoes afford as cheap and valuable food for fattening cattle and sheep as can be found in any country whatever. The value of the turnip, while it fattens sheep well, consists mainly in the economy of feeding, as they do not require to be dug when folded with sheep, and as it adds so vastly to the fertility of the ground when restored to it after having passed through the bowels of the sheep consuming it. It should be remembered that the direct reliance in England in fattening their huge cattle is turnips and straw. It cannot be doubted that the wool-crop of the South might be made to equal the present value of the cotton-crop, with rather an increase of the latter.

These are the natural reliances of the South in fattening for market both cattle and sheep. If we choose to bring in foreign adjuvants, which will be wise, throughout nearly the whole South, in land sufficiently rich, Lucern, clover, timothy, herd's-grass, orchard, meadow-oats,

and blue-grass can be grown. These alone will not fatten for market in the winter, but they prepare well for it.

The advantage of fattening live stock on the plantation is twofold. It is not merely the moderate profit on the animal, but the greater profit of enriching the soil.

A great defect of southern planters is that they do not keep, in the way of fertility, what they get. That is to say, when they make a piece of ground, they afterward continue to work it in exhausting crops until all the richness is gone. They cannot get possession of a goose without ripping up the poor bird. The true policy is not merely to keep the ground rich, but to make it richer. To illustrate: If a piece of rich land is put in cotton, it may be followed with corn, small grain, with clover being sowed among the corn in August. If the clover is allowed to occupy the ground for two years and to go to seed, even under a longer rotation than the above, it will not be necessary to sow it again. As soon as the ground is at rest, it will be covered with young clover. Three years ago, on this farm, a piece of ground was put in turnips, manured in the drill with farm-yard manure. The turnips were eaten on the ground by sheep. The next year it was put in corn, the next in cotton worked very clean, and this year in oats. After the oats were cut a fine stand of red clover appeared. This seed was never sown, but must have been in the manure applied three years since to the turnips. This is not a solitary case. Many similar instances have occurred within the observation of the writer. It is such plants as clover and pease that not only hold but increase the fertility of the soil.

In order to bring these remarks to a point, and to illustrate the writer's views of diversified husbandry, the following rotation of crops is submitted as one suited to the agricultural condition of the South.

We will suppose a farm of 500 acres of open land under fence. Let 250 acres be devoted to arable purposes and the rest to grazing. The rotation might be as follows: 1. Cotton and corn in the same field in suitable proportions. 2. Oats sown in August on the cotton and corn land. 3. Rye, or rye and wheat, sown in September, the land having been twice plowed in order to kill the germinant oats. 4 and 5. Clover, if the land is in sufficient heart to produce it; if not, the fourth year rest ungrazed, and the fifth year sheep and cattle penned upon it every night during the year, using a portable fence. An ordinary farm of 500 acres will support 500 sheep, besides the crops in the above rotation. The oats and rye will feed them during the winter nearly or entirely, without injury to the grain. Five hands would be sufficient to work such a farm and take care of the live-stock.

During the first year the following results might be expected from an ordinary farm, without manure:

25 acres in cotton, 12 bags, at 15 cents	$900
25 acres in corn, 250 bushels, at $1	250
50 acres in oats, 500 bushels, at 80 cents	400
25 acres in rye, 200 bushels, at $1	200
25 acres in wheat, 150 bushels, at $1.50	225
Increase and mutton sales of 500 sheep	500
Wool, 3 pounds per head, at 33 cents per pound	500
Manure, at $1 per head	500
	$3,475

Separately each of these products is small, still the aggregate result is more than $600 per hand. Yet this is nearly three times the average products per hand in the cotton States. That average is in Georgia,

$209; in South Carolina, $202; in Virginia, $211; in North Carolina, $214. These are the lowest averages.

The farm-products given in the case above supposed are the result of the first year of the rotation. The next year the cotton and corn would be more than double by penning 500 sheep at night on 50 acres. It is the writer's experience that ten sheep regularly penned will manure well one acre in a year. Five hundred would, therefore, manure well 50 acres. The appearance of the ground would not indicate this high manuring; but it should be remembered that the liquid manure, which is equal in value to the solid, is not visible. If, in addition, a stock of cattle were kept and penned on the same 50 acres, then fertility would be increased in proportion. It should never be forgotten that accumulating, saving and applying manure, is as serious a business of the farm as making corn or cotton. At the end of the fifth year of this rotation the change in the farm would be equal almost to a transformation, the crops being doubled or trebled, without (which is a most important point) any material increase of labor or other expense.

This improvement of the soil, accompanied at first by moderate profits, and with a great diminution of vexations and unreliable labor, should be the great end of the Southern planter. It involves a double profit from increased production and increased salable value of the soil.

It will not be inappropriate or without value to quote in this connection the language of Lord Bacon, one of the greatest men who has lived:

> And of all sorts of thrift for the public good, I would, above all others, commend to your care the encouragement to be given to husbandry and the improvement of land for tillage. There is no such usury as this. The king cannot enlarge the bounds of these islands, which make up his empire, the ocean being the unremovable wall which incloses them; but he may enlarge and multiply the revenue thereof by this honest and harmless way of good husbandry.—(Lord Bacon's Works, vol. 2, p. 387.)

The only stain upon the memory of this illustrious man was his criminal love of money. Yet in this letter of grave advice to the prime minister, the Duke of Buckingham, as to the conduct of public affairs, he unhesitatingly gives it as his opinion that the improvement of the soil is the highest usury—in other words, the most profitable use of time and money, both by private persons and public functionaries.

With the southern climate and products, and the wonderfully recuperative power of the soil, if the counsels of Lord Bacon were heeded and practiced, how great a change would be witnessed in the plantation states in comparatively few years. The southern planter has heretofore been an undutiful son to his mother earth. But with all a mother's fondness, she is ready to forgive and bestow her smiles and her parental favors upon her children who return to their allegiance. If they yield to her their first homage and render to her their chief care, the lacerated surface would be healed, the gaping chasms would be filled in their due season, the fields would wave with grain, or be white in autumn with cotton as midwinter's snow, and upon her pastures, verdant with grass, the lowing herds, the blatant sheep, and the bounding colt would rejoice each after its kind as the Creator made them, while the planter, now rent with anxiety, as he then looked over this peaceful scene would bless God for his happy, teeming home.

While in these pages the errors of the southern planter have been freely condemned, it has not been meant to intimate that there has been a want of energy, or industry, or pains-taking and self-denying effort on his part. There has been no deficiency in any of these particulars; the

error has consisted in their wrong direction. There are victories of peace which are higher, nobler, purer, than those of war. The latter the planter lost; the former he has gloriously achieved.

If to accept the inevitable, to meet misfortune with calmness, adversity with fortitude, losses without repining, aspersion without reply, failure with redoubled effort, be heroic, then the planters of the South, as a class, have been heroic, or the world has not known moral heroism. Stunned for a season by defeat, stripped of property, seeing their wives and daughters, raised in affluence, reduced to menial service, without money and without credit, the whole labor system disorganized, Providence frowning upon them with an unbroken sequence of unpropitious seasons, the mouthing politicians wearying and worrying them with things of the past, when their children were crying for bread, they did not falter nor were they led astray, but with sublime energy devoted themselves to the restoration of their lost fortunes.

It is to be deplored that such heroic effort was for the most part fruitless. Their condition is outwardly improved, but inwardly debt is silently gnawing at their vitals. Their efforts were in the wrong direction. The skies had changed, but they had not changed with them. They were accustomed to work in one way, and they knew no other way. Their habits were inherited and they could not shake them off. Hence, in the new order of affairs, they accumulated rather than removed difficulty. As a class throughout the South, it is to be feared that the cotton-planters are in a more gloomy condition than immediately upon the close of the war.

It is perhaps unreasonable to expect material changes in habits to which they are wedded, among men in advanced life. But among the young planters there is hope of a salutary change. To them especially, the views which have been presented in this paper are earnestly commended. They are not the theory of an individual, but the practice of every nation in Christendom among whom agriculture flourishes. They claim no originality, nor are they novelties to those who are familiar with the agricultural practice of other peoples. When compared with other systems of agriculture they will be found in practice wherever the tiller of the soil is most prosperous.

A sensible man whose house has been burned down, before he rebuilds will naturally inquire if other persons in other places are not enjoying conveniences which were not to be found in the old dwelling. The planter has been required to build up a system of farming upon the ruins of the old one. He must, in a sense, and to a certain degree, forget the agricultural past. He must inquire how other persons in other countries have managed and prospered who never owned negroes. And so far as differences in soil and climate will allow, must appropriate to himself whatever is excellent in their management. If he cannot travel, these things must be learned from conversation with informed men, books, and agricultural periodicals. He should never forget that farming with slave labor, and farming with free labor, are as different as slavery and freedom.

In this paper nothing has been said of the oppression of the planter by merchants, transportation lines, &c. This burden is almost beyond endurance. The poor planter is the pigeon to be plucked. The shortest and best mode of relief is to sell direct, not to the spinner beyond the sea, but to the spinner at home. True, we have but few cotton-factories at the South. The statement that the South has not sufficient capital to build cotton-factories is incorrect. If the planters would adopt the practice of diversified husbandry, planting only one-half the

usual amount of cotton, the sale of the mules for which they would then have no necessity, and the saving of the wages of the hands necessary to work them, would furnish a sufficient capital to fill the whole land with the hum of machinery. Twenty-five thousand dollars would make a beginning of a factory which, well managed, would end in a large and prosperous establishment. It would require the sale of 167 surplus mules at $150 each to furnish $25,000. What large cotton county in the South, under the proposed change, could not furnish this surplus number? Some years before the war, two enterprising men began a cotton-factory in Chattooga County, in Georgia, with a capital of $25,000. No railroads were then in existence in that section. Now, the nearest railroad is twenty-five miles distant. Yet, from profits alone, besides fair annual dividends, the sum of $200,000 is there invested, a population of 900 persons is supported, and the farmers of the vicinity, in various ways, annually save more than $10,000. The cotton-mills must be brought to the cotton—at least those which manufacture coarse fabrics. It would be a grand consummation if not a bale of raw cotton were shipped from the South. This would not only sweep away the whole species of cotton-leeches but would relieve the planter from the wholesale plundering which strips him of the small profits which he might otherwise make. For the accomplishment of this purpose it is useless for him to call on Hercules. It is in vain to look to the North or to Europe for manufacturing capital. The planter must put his own shoulders to the wheel, content with moving it, it may be at first, but a few inches at a time. This can be done by converting capital, now not idle but hurtfully used in the impoverishment of the soil, into an instrument of solid prosperity.

Those persons at the North who may have thought of making considerable investments in southern lands, will probably say that in these pages a gloomy view of southern agriculture is presented. It is gloomy in the present fact, but cheering in the future possibility, and, it may be added, probability. To such persons the writer would say that portions of the South offer great inducements in mining and manufacturing. Equal inducements are offered on the largest scale, and with the largest capital, in raising sheep and cattle. These may be profitably numbered by hundreds and thousands, and may be kept at probably one-half the expense which would be incurred at the West. But the South offers no inducement to the investment of large capital in cotton plantations to be worked by negro labor. Such investments by northern men and Europeans have ended almost invariably in sad disaster. But if the class of northern men who usually "go West," adventurous and industrious young men with small families, who labor with their own hands, would come to the healthy portions of the South, their prospects of health, comfort, and steady and even rapid accumulation, would be bright. This is the population which the South most needs, for a twofold purpose: one as purchasers of our excess of land, the other to illustrate before the eyes of the cotton-planter the benefits of mixed farming. By the mass of cotton-planters, stock-raising as a business, and the cultivation of clover and the grasses, are but little understood. One successful practical example in a neighborhood would be worth volumes of written or printed instruction. Peaceful, industrious, intelligent, and law-abiding men of this class would be welcome in all parts of the South; wherever a helping hand was needed, it would be cordially extended to them.

If there be one class of men rather than another throughout this great country, whose duty and inclination it is to forget the painful past and

to cultivate and maintain peaceful relations with their fellow-beings, it is the tillers of the earth, which brings forth its fruits alike to the industrious wherever found, and which is the handiwork of Him whose great glory it is to dispense "peace on earth and good will to men." In the exhibition of this kindly temper, no portion of the great brotherhood of farmers will be more decided than the planters of the South.

THE DAIRY.

EASTERN AND WESTERN DAIRYING.

While the dairy-factory interest is gradually extending in all directions, its greatest current expansion is to be found in the Western and Northwestern States, offering the advantages of lower cost of land and feed as compared with the old, rich, dairy regions of New York. The increase of production in the latter State in 1874 was relatively small, while western agricultural journals reported the establishment of many new factories, a portion of them in sections hitherto entirely unused to the business.

New York maintains its supremacy in the market, the natural accompaniment of compact volume of production and superior character of make. This latter is not merely the consequence of better grasses and better climate; it is quite as much the result of skilled and careful practice on the part of milk-producers and dairy-manufacturers. Competition, interchange of experience, and a growing sense of individual responsibility among patrons of factories at the West have lessened differences in prices of eastern and western dairy products. But in the matter of butter western producers still suffer enormous losses, and even their better grades are depressed in price by the bad reputation of a great proportion of their make. Fully aware of the difficulties to be surmounted, and at the same time encouraged by the progress of the past few years, leading dairymen in that region continue their efforts for the extension of the factory system in butter-making, and for the better appreciation by dairy farmers of prime points of management. The establishment of regular market-days and special boards of trade in centers of dairying at the West has done much to advance the profits of producers.

Even the disadvantages of inferior soils and grasses, in western dairy regions, are being gradually removed as well-directed cultivation works out its ameliorating effect. In exemplification of the history of dairying in Wisconsin, Mr. Chester Hazen, president of the Wisconsin Dairymen's Association, says that in his county of Fond du Lac there were in 1850 but three or four dairymen who made cheese, and they were from the State of New York. There was then very little sale for cheese. Farms were new, and there was very little land in cultivated grass; the soil was too alkaline for really-good pasture or mowing, although excellent for grain. This alkaline quality, the result in great measure of repeated burning of vegetation during hundreds of years, disappeared gradually, even from uncultivated fields, as the supply of ashes was cut off, and much more rapidly from cultivated soil, and the land became more adapted to grass. This change in the character of the soil necessitated change in the order of crops, and with this change came an increased dairy-production. The importance of this branch of in-

dustry in the State is shown by the fact that, from their origin in 1864, the number of these establishments had increased to 130 in 1873, manufacturing 10,000,000 pounds of cheese.

REPORT OF THE NEW YORK BUTTER AND CHEESE EXCHANGE.

The following significant paragraphs appear in a late report of a committee of the New York butter and cheese exchange, bearing on proposed changes in the classification of butter in that market:

The celebrated fine State dairies (of New York,) held in reserve for winter market, are made only in the finest dairy districts, are most skillfully and perfectly made, and packed in uniform packages, numbered as packed, and kept in cool dairy cellars, expressly fitted, and in many instances cooled by running streams of water. Until this system of dairying, with the requisite conditions of pure water and grazing, are introduced in the western states, their product will not compare with that of the eastern states. This can be accomplished by increasing and improving the herds and grazing and the adoption of the New York dairy system, or by the creamery system of taking the milk, where the dairies are small and scattering, to a common factory for the manufacture of butter of a uniform quality, the same as the factory system in cheese-making.

Of western butter arriving in this market, it is estimated that less than 2 per cent. is made on the system followed in the State of New York. In the Western States, as a whole, the herds are comparatively small, and the waters and grazing in many sections impure. The butter is gathered in small parcels and reworked together, in order to have it uniform in character, all of which is more or less injurious to its keeping qualities. While great strides of improvement have taken place, to the extent of an enhancement of its market value some 40 per cent. in two or three years, there is still room for great progress by the adoption of the eastern system, and co-operating with the transportation companies in recommending and encouraging improved facilities for safe and quick transportation.

The committee, in conclusion, recommend that in the New York market, butter be divided into two classes, eastern and western, with corresponding grades. Western dairymen object that, with this classification, eastern butter obtains an unfair advantage over like qualities of western, and that the just classification would be by qualities, without division according to region of production.

AMERICAN DAIRY-PRODUCTS IN ENGLAND.

In the general market, constantly varying character of packages of dairy-produce received from any given region must necessarily work injury to the producers of that region, taken in mass, skilled and careful makers suffering to greater or less extent from the shortcomings of the careless and unskilled. The superior workman must bear some undeserved loss in present price, and in that reputation which gives guarantee of future profits. We have seen that such inequality of character tells largely on prices of Western dairy produce in our own chief center of trade; and when we turn to consider the standing of American cheese in the English market, we find a similar depressing influence there at work. A late issue of the Scottish Farmer remarks that American dairymen can make good butter and cheese, but that neither of these commands a relatively high price in that market, for the reason that no two cases of receipts are alike in taste, flavor, or color. This irregularity detracts from the value of every lot brought in; and although this has been repeatedly pointed out by dealers, there has been no marked improvement, notwithstanding improvement in particular packages. In special respect to butter, it is added that French butter is very equal in character. Examination of one package answers for all, so that they pass like bank-notes, and continuous arrivals have the same characteristic. Great attention is paid in France to uniformity in color, taste, &c. Kegs are exactly alike in size, and are filled by machinery to precisely the same weight.

There can be no doubt as to the practical value of the strictures on the character of our cheese export. The same criticisms, in substance, have often been uttered by experts in our own country. As regards our butter export, we cannot at present expect any essential change in its character, since it is but the refuse of our home market. But the above suggestions are entirely applicable to our home trade in butter.

A WELL MANAGED CREAMERY.

In exemplification of good factory management of butter, we give, in part, Professor Arnold's description of practice at the Speedsville Creamery, situated on the boundary line of Tioga and Tompkins Counties, New York. The buildings of the factory are old, and the surrounding country is rough and uninviting in appearance, but the interior of the establishment is thoroughly clean, and its air is pure. The arrangements are of the old style, and six persons are required in manufacturing the milk of 550 cows. In the room for raising cream there are five pools 20 inches deep. Four of these are sufficient to cool the milk of 800 to 1,000 cows, and the fifth pool, smaller than the others, is used for holding cream. By this means there can be division of water for cooling, so that each mess of the day's milk may be set and cooled by itself, not warming up milk already cooled. There is a good supply of water, entering the factory at a temperature of about 50°. Common cooler-pails are used. The factory receives 12,000 pounds of milk daily, on an average. Soon after the present manager assumed charge, he had ventilators put in the covers of cans of all the patrons who could be induced to accept the improvement free of cost. Throughout the hot season taint was prevented in the cans thus altered, but there has been occasional trouble with milk in the unventilated cans. Here it is suggested that, as many patrons of creameries will not take the trouble to cool their milk thoroughly, the practical remedy lies in the use of ventilated cans, and that in establishing a creamery and butter factory the use of such cans should be made obligatory on all parties supplying milk. In Mr. Arnold's opinion, when milk is carried no farther than a customary distance to such factories, the cream can all be raised.

The churning at the Speedsville Creamery is done by two rocking-shafts, driven by steam. The churns are barrel-formed, with a bottom head 18 inches in diameter, inside measure, and 30 inches high, holding 1¼ barrels each. The dashes or floats are unusually large. They cover three-quarters of the area of a horizontal section of the churn. Two forms are used. One of them, recently introduced, is made of 2-inch ash plank, and is a solid circle 16¼ inches in diameter, made concave on the under side. The hollowing out on the under side is done so that when the dash, after being raised above the cream, goes down, a cushion of air will strike the cream instead of the hard wood. By this means the least possible injury is done to the grain of the butter. The other style of dash is made in the usual way, with cross-floats which are large enough to cover as much surface as the solid circle. The churning is done with a slow stroke, counted at thirty-four to the minute, and at a temperature of 58° in summer and 60° in cool weather, and requires from one to two hours to bring the butter, the cream being varied a little in temperature and quantity, so that the churns shall not all come off at once. When the butter begins to appear in granules, the pace is slackened down to half speed, or below, and cold water enough put in to increase the contents of the churn so much that the dash, in its upward stroke, will not rise quite out of the cream. In this way the dash is prevented from pressing the granules together, and they become hard without adhering, and the butter is gathered in a granular form, in lumps of the size of peas and grains of wheat, which the cold water added makes very hard. When the gathering is completed, the churn is detached and the butter taken out in this form and dropped into a vessel of cold water (an extra churn is used for this purpose) and rinsed twice, when it is perfectly cleansed of buttermilk and ready for salting without a particle of working. All that is required, the butter being in granules, is a little stirring with the hand while in the cold water. The hands of the operator are employed for this purpose, and for taking the butter from the churns, because it can be handled with less compression than with a ladle. The hands are prepared for this work by plunging them first in warm water,

and then in cold, and rubbing them till they are soaked so that butter will not stick to them, and till they are so chilled as to check perspiration entirely. This work is done so carefully that the butter keeps its granular form without even leaving hardly a print of the hands upon it. After washing, it is placed upon the butter-worker, which is composed of an inclined slab and lever, and one pound of Ashton salt is thoroughly incorporated with 16 pounds of butter. It is then set aside for a few hours for the salt to dissolve, when a part of the brine, which is as clear as dew-drops, is worked out, and it is ready for packing. Firkins are mostly used for packing. They are made of oak, and hold 104 pounds. Before using they are first soaked in strong brine, cold; then in boiling-hot brine, and this is left standing in the cask till it is cold and until the firkin is wanted for use. The loose head is treated the same as the body of the cask.

Concerning the construction of churns, Mr. Arnold says that a dash-churn with a diminutive dash requires a multitude of strokes to bring the butter, which comes so unevenly that a second or third churning of the same batch will often be rewarded with a fair return; the dash should be so large that in its downward motion it will crowd the cream rather than whip through it.

On visiting some creameries in Orange County, which send butter daily to the New York City market, he noticed some imperfections in churning arising from defects in construction of churns, and saw that the buttermilk was not completely worked out from the butter. But the milk and cream had at the outset been well cared for, the butter was high colored and finely flavored, and, though not suited for distant transportation and long keeping, was very acceptable for ready consumption and brought a high price.

The contrast to the Speedsville example is set forth in the statement of Mr. Harris Lewis, that there are cheese-factories which never will be able to make another pound of first-class cheese until the filth that has accumulated beneath them shall have been removed, or the buildings themselves removed. He had visited a factory in his own county where the whey had been suffered to find its way beneath the floor, which lay near the ground, and in walking, the floor would spring beneath his weight and the maggots would rise freely from the cracks. But not alone factory-managers are inexcusably in fault, for he adds: "It is a solemn fact that milk is carried in the spring and fall to some of our cheese-factories with cow-manure mixed with it in the liquid form and in the lump. * * * These taints do not cease their work under the manipulation of the milk at the factory; but they continue their work, and the end, in butter, is rancidity, and in cheese, rottenness." Illustrating the manner in which these taints exhibit themselves in the final product, he said that a grocer in his region once asked him to examine some cheese which had given dissatisfaction. The article was fine, rich, and salvy in appearance, but the odor and taste plainly suggested that the milk had been fouled with manure. A little of the latter could be made to go a great way in milk or its manufactured product.

AERATION AND CLEANLINESS.

Mr. Hubbard, a dairyman of Brimfield, Massachusetts, gives a similar experience showing the evils consequent on want of cleanliness in milking or in care of milk. As to neglect in cooling milk he says that milk is shipped from his locality to Boston once in twenty-four hours, and that dealers have more trouble with evening's milk shipped in the evening than with morning's milk shipped at the same time, the reason being that the latter was allowed to cool a sufficient time before closing the cans, and the opposite was the case with the evening's milk.

Mr. Lewis states an experiment in aerating and cooling milk. He divided a quantity of milk from his dairy into three portions: lot 1 was

aired and cooled to 51°; lot 2 was shut up in a can at the same temperature which it had as it came from the cow, about 98°, and was exposed to the heat of the sun as milk often is when carted in the open wagon to the factory or the village-market; lot 3 was exposed to bad odors. Lot 3 putrefied in 40 minutes, and in 70 minutes was rotten; lot 2 reached the same condition in seven hours; lot 1, after standing one hundred and twenty hours, was found perfectly sweet.

Milk strictly pure and well cared for is the foundation of successful dairying. Yet, often as this principle has been enunciated and often as it has been carried out in individual practice, there are thousands of milk-farmers who disregard it, and foul pastures, impure water from stagnant pools or tainted barn-yard wells, harsh treatment, and careless milking continue to be fruitful causes of bad milk. Frequently farmers, correct in other particulars of practice, act on the supposition that water quite unfit for the drink of human beings may be entirely suitable for milch cows. Unventilated or cold, imperfectly boarded cow-barns are also stumbling-blocks in the way of American dairying. Mr. Z. A. Gilbert, a well-known agriculturist of Maine, speaking of the favorable prospects of associated dairying in that State, points out these errors and others of which he has been cognizant—the driving cows considerable distances to ponds or streams for drink during inclement winter weather, and the want of proper provision for foddering cows in summer, during drought and scanty pasture. "In Maine," he says, "more cows go hungry in summer than in winter." Mr. Arnold says that when tight barns first began to be built in Central New York dairymen were much surprised at the saving made in feeding. It was found that there was a saving of one-third of the feed which had been required in the open barns formerly in vogue. He adds that care should be taken to provide sufficient ventilation in tight, warm stables.

HEATING MILK FOR BUTTER, &C.

Heating milk in preparation for butter is no new procedure, but of late its advantages and limitations in use have been more precisely defined. In recent experiments, milk heated to 130° and set away to cool of itself, kept sweet longer than unheated milk cooled to 60°. The cream rose more quickly and as perfectly. The yield of butter was quite as great, and had a purer flavor and brought a higher price than butter from milk not heated. Heating is found a very effective remedy in cases where milk has been tainted by retention of animal odor, the latter being quickly thrown off at a temperature of 130°. One experimenter reports that, May 18, he scalded to 130°, and let the milk stand seventy-two hours, and then made it into excellent cheese and butter, and that several lots of milk were afterward successfully treated in like manner. In one case, having received a can of tainted milk, he scalded a part of its contents to 140°, the other portion not being heated, and set both lots in cold water, side by side. That not scalded soured in twelve hours, and its cream turned purple. The scalded milk was put in for cheese at the end of sixty hours, sweet and well flavored.

This employment of heat is rather indicated as remedial, and is not recommended where milk is already in first-rate condition.

MICROSCOPIC INVESTIGATIONS.

The microscopic investigations of Dr. E. L. Sturtevant, of Massachusetts, in comparing the butter globules of milk from different breeds of

cows, show that the globules in the milk of Jersey cows are large and comparatively uniform in size; those in the milk of Dutch cows are small, but uniform in size; those in the milk of Ayrshires are irregular in size, ranging in magnitude between the Jersey and the Dutch. The larger the globules, the quicker they rise as cream; the more uniform their size, the more complete is the separation of the cream from the milk. At the temperature of 70° Jersey milk gave up all its cream in four hours, and the line of separation of the cream from the milk was very distinct. The Ayrshire milk gave up its cream in twelve hours, and the milk of Dutch cows required a somewhat longer time. When the different creams were mixed and churned, there was this disadvantage, that though a portion of the butter came quickly, a much longer time was required for another portion of the churning. This being the case, some of the first-obtained granules were injured by overchurning, and the total product of butter was not as great as when each kind of cream was churned separately. The experiments, to such length as they were carried, indicated that the further from calving the smaller the globules, and the more uniform in size. Feed and condition appeared to exercise an influence on the size of the globules and on the grain of the butter.

FRENCH DAIRY-ROOMS.

In its issues of February and March, 1874, the *Journal d'Agriculture Pratique*, of Paris, publishes an elaborate account of the farm of Lisors, the property of M. Achille Pouyer, and situate not far from Paris. We give some particulars concerning the construction of the dairy-rooms of the farm. These formerly, according to the custom of the region, had their floor below the level of the soil, but a visit to the island of Jersey, and to the canton of Isigny, near the English Channel, which contain the dairies producing the choicest butter for the London and Paris markets, induced the proprietor to reconstruct his dairy-rooms on an improved plan. In the former, partly subterraneous construction there prevailed generally an injurious humidity, and the ventilation was quite imperfect; so that, notwithstanding all the care exercised in superintendence, a persistent odor greatly deteriorated the cream and butter. The new dairy-rooms are included in the farm-house, and are on a level with the surface of the ground. They are three in number: the summer dairy, the winter dairy, and the creamery. The windows by which the rooms are lighted are furnished with blinds, and the walls are pierced above and below by ventilating orifices, over which wire cloth is stretched to prevent the entrance of flies. The winter milk-room is comparatively small, and is warmed by an exterior stove in order that no dust may fall on the cream. The summer room is large and high. In order to secure an equable temperature and complete ventilation, there is suspended before a large opening in its eastern wall a curtain of sail-cloth which, agitated by a wind-current, maintains a stratum of fresh air, neutralizing the heat of the sun's rays. Furthermore, the apartment is encircled by an iron water-pipe having an interior diameter of .05 meter or about 2 inches, and furnished with a cock for regulating the flow. To this pipe are fitted at intervals of 2 meters, or 6½ feet, brass tubes pierced with numerous small holes, hardly more than capillary in size, from which water is made to ooze at will. By this apparatus may be maintained on the pavement of the apartment a thin watery covering, constantly evaporating and communicating a refreshing coolness to the air. Any excess of water which may occur is carried off by an underdrain, the pavement having

an inclination suited to this purpose. The tiles used for paving are about one foot square and 1½ inches thick, and are laid in Portland cement, and the walls are covered with this cement up to the height of 20 inches above the pavement.

BUTTER-FARMING.

A butter-dealer in the State of New York gives these particulars of certain dairies in Chautauqua County, whose product he has handled: Dairy of A. Tefft, numbering twelve cows, made from March 15, to December 10, 1873, two hundred and sixty-nine days, 3,565 pounds of butter, averaging 297 pounds per cow; average price per pound, 31.7 cents; gross returns per cow, $94.17. The herd received as an extra daily feed a total of 24 pounds of corn and oats, ground, and 25½ pounds of bran in skimmed milk; entire cost, 53.9 cents; net proceeds per cow, $82.09. O. Brunson's herd of seventeen cows averaged for two hundred and sixty-nine days 280.82 pounds of butter per cow; average price of the butter, 31.14 cents. A. P. Brunson, during the same length of time, averaged from twenty-four cows 246.54 pounds of butter per cow.

Mr. William Depue, of Hopewell Center, New York, reports in the Ontario Times that he has a half-blood Alderney cow, about six years old, that, during the year April 5, 1873, to April 5, 1874, made 504 pounds of butter, besides supplying milk to the family.

At a meeting of the Franklin (Mass.) Harvest Club, in the early part of 1874, Mr. H. C. Haskell, of Deerfield, made the following statement on his herd of pure and grade Jerseys for seven years:

Year	Number of cows.	Average yield of butter per cow.	Average receipts per cow.
		Pounds.	
1866	6	276	$140 40
1867	6	305	135 90
1868	6	287½	137 65
1869	6	289	147 81
1870	7	289	133 27
1871	7	285	121 98
1872	8	279	133 30

This statement does not include milk and butte r used in the family nor the raising of calves. Owing to certain circumstances no exhibit of the herd was made for 1873. One heifer, weighing only 540 pounds, came in at fifteen months of age, and commenced making six pounds of butter per week. Mr. Haskell gives the following items of average cost of feeding his cows during the year ending May 1, 1874: Pasture, twenty-eight weeks, at 75 cents per week, $21; 1¾ tons of hay, at $17 per ton, $29.75; 20 bushels of corn, at 72 cents per bushel, $14.40—total, $65.15.

"E. K." of Whitewater, Wis., writes to the American Agriculturist that from a Jersey cow four years old, owned by him, 315⅝ pounds of butter were made in ten months, from March, 1873, to December, 1873, inclusive. The amounts per month were: In March, 40⅝ pounds; April, 41⅝ pounds; May, 31⅝ pounds; June, 39 pounds; July, 33 pounds; August, 31¼ pounds; September, 35 pounds; October, 26 pounds; No-

vember, 20 pounds; December, 17¼ pounds. One of the teats of the cow had been accidentally injured.

The following particulars are from statements made in January and February, 1874, by the firm of I. Boies & Son, well-known butter-makers, of Marengo, Ill. They had, at the latter date, 134 cows. The rule of management was that these should come in in September and October, after going dry sixty days. With this course comparatively little butter is made in hot weather. They were buying 4,000 pounds of milk daily from neighbors, this supply being kept up in winter as well as summer. They aim to feed their cows all that they can with safety. Their annual average of butter per cow is about 300 pounds, bringing 40 cents per pound at home. They feed the sour milk to hogs, from which they derive a good profit, notwithstanding low prices of pork. The manure obtained from their animals brings the farm into a fertile condition; it had enabled them to obtain from their corn-land 100 bushels per acre. The daily feed in winter to each cow in milk consists of ten pounds of corn and oatmeal, mixed in nearly equal proportion, one pound of oil-meal cake, one full feed of corn in the stalk, and all the hay the cow will eat—estimated at an average of not more than ten pounds daily, chiefly timothy. It is calculated that each cow will eat twenty bushels of corn in the stalk during winter. The ration of oil-cake is highly valued, and dropping it has at once caused a shrinkage of milk; but too large use of the cake would injure the butter. The cows receive the meal during the whole time that they are in milk, but the hay and unhusked corn are given only in winter. The cost of keeping a cow for the year is placed at $42, including $27 for purchased food. The farm has 330 acres of tillable land. In 1873 about 100 acres were in pasture; 100 tons of hay were produced, and about 1,000 bushels of oats; 45 acres were in corn. For the winter of 1873–'74 the amount of purchased hay would be about 70 tons, and all the meal used would be bought. The hogs are kept thirty to sixty days, receive on an average 4½ bushels of corn each, besides sour milk, and their average gain in weight is estimated at 110 pounds. In the case of twenty hogs, purchased at $8.12½ per one hundred pounds, they were fed for forty days, and then sold at $8 per hundred of live weight, realizing $111 over their first cost and the cost of corn eaten. It was estimated that the number of hogs bought, fattened, and sold during the year ending in April, 1874, would be nearly 1,000.

In April, 1870, the firm commenced, without experience, to make butter from forty cows. The next winter they shipped milk to Chicago, but sometimes found it difficult to reach the train; also met with loss through damaged cans, and stealing of milk when on the cars. The next summer they were offered 12 cents per gallon for milk delivered in Chicago, and decided to make butter, which they have continued to do since then.

DAIRY STATISTICS.

At the meeting of the Vermont Dairymen's Association in the latter part of January, 1874, the following statements were presented concerning herds of Jersey cows in Pomfret: Mr. Obed Whipple, jr., has 15 cows, including five two-year old heifers which came in in June and July. Besides milk, &c., used in his large family, he made, in 1873, 3,943 pounds of butter, which was contracted for at 60 cents per pound. In summer he fed two quarts of meal daily, adding four quarts of corn after September 1. In the third week of December, a trial with three new milch-cows showed a pound of butter from 17¼ pounds of milk. Mr. E. S. Wood

has eleven cows; has made since March 16, 1873, 2,933 pounds of butter. In December he made three trials respecting the quantity of milk required for one pound of butter. In the first trial the milk stood forty-eight hours, and 12¼ pounds of milk were required for one pound of butter. In the second trial the milk stood thirty-six hours, and 12⅗ pounds of milk were required. In the third trial the milk stood forty-eight hours and 12½ pounds of milk were required. In June he tried twelve or fourteen cows at different times, with an average result of a little over 16 pounds of milk for one pound of butter. In these dairies the milk was set in common milk-pans on milk-racks. Mr. O. M. Tinkham has a cow four years old which came in March 15, 1873, to come in again March 7, 1874, and which gave, in the second week in January, 8 pounds of milk per day, yielding 11½ ounces of butter, being at the rate of 11⅛ pounds of milk for one pound of butter. Mr. Tinkham did not find the old-fashioned dash-churn available for Jersey cream, on account of the thickness and solidity of the latter. Professor Arnold remarked that thick cream should always be thinned before churning. In answer to inquiry as to the reason why one Pomfret dairyman got only 43 cents per pound for butter, while another got 60 cents, Mr. Tinkham said that the butter of the former was put up in tubs, and that of the latter in one-quarter-pound balls, wrapped in muslin, packed in tin cans surrounded by ice, and expressed to Boston.

Mr. Bliss said that in Franklin County, Vermont, the manufacture of butter is found more profitable than that of cheese, and cheese-factories are therefore suffering in point of business.

An account of the operations of the Keeler Butter-Factory, Franklin County, New York, states that the season of 1873 commenced May 26 and closed November 3; 150 cows were employed, and 395,706 pounds of milk were received, from which were made 17,395 pounds of butter, showing an average of 22.75 pounds of milk for one pound of butter. There are said to be about twelve other butter-factories in the county, employing from 150 to 400 cows each. The butter is of excellent quality. In 1873 a large amount was shipped to the Boston market.

Mr. G. E. Brackett, of Waldo County, Maine, reports that associated dairying is making rapid progress in that State. The first cheese-factory in Maine was established about three years ago. In 1873 there were twenty-three cheese-factories in the State, and, in addition, a large number were incorporated by the legislature in the early part of 1874. In respect to Waldo County, which is taking a prominent position in associated dairying, the number of cows in towns where cheese-factories have been established has increased 10 per cent., and there is prospect of a much larger increase in 1875. The average number of cows per factory is as yet small, being estimated at between 150 and 160.

The cheese season of 1874 opened with good prices and a quick demand. So pressing were buyers that an unusual amount of green cheese was taken from factories. In July a temporary panic occurred in the market, and prices were suddenly and greatly depressed, but soon commenced rising, and a short fall product consequent on drought, assisted in bringing best grades nearly to the figures of the early part of the season. The depression in July was attributed to a reaction from the rush of preceding months, and to the large amounts of imperfectly-cured cheese taken on the market. Large quantities had gone forward at six to fourteen days from the shelf. The deduction drawn from the fluctuations of midsummer is that while manufacturers can hardly be expected to hold newly-made cheese in opposition to urgent and liberal offers, they should remember that a present success with imperfectly cured

cheese is not without its prospective drawbacks in the consequences of a depreciated reputation, and they are advised, as a precautionary measure, to withhold their brands from cheese going in partly green condition to dealers, and thus disavow responsibility for imperfect curing. To the argument that cheese will, under ordinarily favorable circumstances, cure well after shipment from the factory, it is replied that though green cheese may not spoil under such circumstances, it cannot ripen to that flavor which it would obtain when cured on the shelf. Generally, prices are depressed in July and August, owing to the large amounts of cheese hurried forward by makers at that time, and it is claimed that factories provided with well-contrived curing-rooms will, by holding cheese during the depressed prices of the heated term, be able to secure prices which will more than counterbalance shrinkage and interest.

WESTERN EXPORTS OF CHEESE.

Mr. C. H. Wilder, a prominent cheese-manufacturer of Evansville, Wis., in a letter to the secretary of the Wisconsin Dairymen's Association, says that during the summer of 1873, he shipped several car-loads of cheese to Liverpool, via New York, and realized quite as much from the adventure as he could have obtained in the home market. But on examining the bills of sales and expenses he found that the latter were more than 25 per cent. of the gross sales, and he became convinced that a considerable saving might be made. Intending to ship still more largely in 1874, and having a large amount on hand at date of November 13, to dispose of, he concluded to make a shipment direct to Liverpool, and to go there in person, superintend sales, make himself acquainted with the best dealers, and study the special requirements of the English market. The undertaking cost him about three months in time, and the saving effected in the expenses of the shipment paid him the pecuniary cost of his trip, about $400; furthermore, very advantageous arrangements were made for the future. Through-freight rates could be got from any railroad station in Wisconsin to any port or railroad station in England, at a cost of shipment not more than 50 cents per hundred greater than from Central or Western New York. The same advances on shipments could be made in Wisconsin as at New York. Wisconsin cheese can be shipped to England ten to twenty days old, and arrive in condition to return larger profits than if it had been held longer at the factory, there being a large saving in shrinkage.

CHEESE-FACTORY RULES.

Mr. L. L. Wight, of Whitestown, Oneida County, New York, sends the following "suggestions for the season of 1874" to the patrons of his factory: 1. Milch-cows should have free access at all times to good running water. 2. They should never be heated by being run, stoned, or dogged. 3. The utmost cleanliness should be observed in milking; and by no means should the hand be wet in the milk. 4. No can of milk should stand where it will absorb the barn-yard or stable odor, or any other scent. 5. The milk should be strained and well aired immediately after having been drawn from the cows. 6. Some arrangement for quick and effectual cooling is at all times very desirable; when the milk is kept at home over night this is indispensable. 7. Scalding all vessels used about milk at least once a day with boiling water, and rinsing them with cold water at night, is essential. 8. Keeping the strippings at home is morally and legally as bad as watering. 9. The

milk should be sent to the factory as soon after milking as possible. Rule 10 touches the times of morning and evening delivery at the factory. Rule 11 reads thus: Any milk which does not habitually keep sweet and pure until 1 o'clock p. m. will be made into cheese by itself, and the cheese sold by itself, the furnisher and furnishers of such milk receiving only the actual avails of his or their own milk. Such persons' milk will again be mixed with the good only when the manufacturer is satisfied that a permanent reform has been made in the method of taking care of it.

DAIRY BOARDS OF TRADE.

At a meeting of the Northwestern Dairymen's Association, in February, 1874, the secretary of the Elgin Board of Trade stated that the board was organized in March, 1872. It held semi-monthly sales for a short time, but the increasing business soon made it necessary to hold weekly sales. Notwithstanding the unfavorable prophesies of certain commission-men, the enterprise prospered. Chicago dealers found it for their interest to attend the sales, and at the close of the year the board numbered over one hundred members, and the total sales had reached $80,000. In 1873 forty-two factories, including several Wisconsin factories, were represented on the board. Sixteen factories sold all, or nearly all, their season's make through this medium, and many private dairies disposed of their products in the same manner, at better prices than could be got elsewhere. Sellers had the advantage of recourse to the bulletin-board showing latest prices of cheese and butter in the principal markets of the country. Through the operations of the organization a large saving has been effected to sellers by avoiding charges of commission-men; and the secretary estimated that in this way there were saved to makers of cheese and butter in 1873 over $18,500. During 1873 there were sold on the board 40,629 cheeses, weighing 1,726,316 pounds, and 62,061 pounds of butter. Total receipts from sales, $219,177.53. At the time of the report there were nine creameries within ten miles of Elgin, selling daily 5,805 pounds of cheese and 1,405 pounds of butter; and these sales would have been made through the board had not the latter closed its rooms for the winter.

The secretary of the Dairy Board of Trade of Sheboygan County, Wisconsin, reported that the board was organized in March, 1873, by the Dairymen's Association of that county. Of 1,070,000 pounds of cheese made in the county during the season of 1873, 452,000 pounds, or nearly one-half, were offered for sale on the sale-days of the board. The organization had been of great advantage as a medium of business and mutual information, and the secretary suggested the employment of similar agencies for the sale of all farm-products.

The Watertown (Wis.) Dairy Board of Trade was organized in 1872, and had semi-monthly sale-days during the season of 1873. Total offerings of cheese during that season, 41,000 boxes. Shipments made up at the board amounted to 5,200 boxes to New York, 5,285 boxes to London, and 363 boxes to Liverpool.

EXPERIMENT IN FEEDING FOR BEEF.

Mr. Josiah Shull of Ilion, New York, commenced November 1, 1873 to feed a cow, judged by him too old to be retained in milk. She was farrow, and at that time in only medium condition, and was fed with corn-meal and pumpkins and what hay she would eat. During November and December she averaged 12 pounds of milk daily, the yield decreasing to 10 pounds per day in January. February 25, the cow

weighed 1,240 pounds. He then commenced giving corn-meal cooked and made into gruel, gradually increasing the amount up to 11 pounds of meal per day. Contrary to expectation the flow of milk decreased, averaging for February 7 pounds per day; and for March 5 pounds per day; and in the latter month the milk began to be poor in quality and blue. She weighed 1,300 pounds March 11, and 1,260 pounds March 25, showing a falling off of 40 pounds in fourteen days. She was sold to the butcher April 1, for $70. Expenses, estimating the value of the hay at $20 per ton, and Indian meal at $1.75 per hundred-weight: Market-value of cow November 1, $15; hay and grain, from November 1 to April 1, $46.50; total expense-account, $61.50. During the period of experiment the cow gave 1,266 pounds of milk, worth, at 1¼ cents per pound, (or about 2¾ cents per quart,) $15.82; price received for the cow April 1, $70; total receipts, $85.82, showing a profit of $24.32. The value of the manure was considered as offsetting the value of the labor, and the milk was placed at its calculated money-value for cheese.

TESTS OF ADULTERATED MILK.

In ordinary practice the quality of a given sample of milk is indicated by its specific gravity and its percentage of cream. A hydrometer float will determine the former point, and a graduated glass the latter. Leaving out of consideration the very exceptional case of strippings, or the last milk from the udder of the cow, the normal gravity of milk of good quality varies from 1.028 to 1.030. A lower specific gravity than 1.027 indicates poor milk, and a specific gravity of not more than 1.025, that the milk is very poor or is mixed with water. As already pointed out, exceptions to these rules of specific gravity occur in cases of strippings, or samples of milk extraordinarily rich in cream, for cream has a low specific gravity placed at 1.012 to 1.019. Such cases would not be likely to occur in the milk trade, and wherever presenting themselves the cream-gauge would serve as a sufficient indicator. On the other hand, an originally good milk may have been almost deprived of cream without addition of water, and thus come to exhibit a specific gravity as high as 1.033. Here the bluish color of the milk and the deficiency of cream, as shown by the cream-gauge, tell the story of treatment. Again, skimmed milk will exhibit a lower specific gravity than unskimmed milk of good quality. It will be seen, then, that the test of percentage of cream should accompany that of specific gravity. The percentages of cream by volume range from less than 4 per cent. for badly skimmed milk, up to 10 per cent. or more for good unskimmed milk.

While the two inexpensive instruments which we have mentioned afford the means of discovering any gross adulteration of milk, the scientific test of adulteration is by the determination of the amounts of contained solids, namely, caseine, fat, milk-sugar, &c. "It is perfectly fair to assume," says Mr. Merrick, consulting chemist, in the report of the milk-inspector of Boston for 1873–'74, "that milk, to be marked pure, should have at least 7.5 per cent. of joint caseine and fat, or 9.3 per cent. of solids not fat, namely, caseine, milk-sugar, and ash together. Any falling below either of these ratios indicates adulteration."

TREATMENT OF PARIS MILK.

Professor Pourian, of the agricultural college of Grignon, states that two-thirds of the milk sent into Paris are forwarded by large dealers having establishments at some distance from the city. One of the largest of these dealers, M. Lecomte, has dairies at Montereau, Dammarie, (near

Melun,) and Monerville, besides a large factory for Gruyère cheese near Montereau, this being chiefly for the consumption of surplus milk. The milk is collected from the farmers by the dealers, morning and evening, in carts of open lattice-work, so constructed as to promote a free circulation of air between the cans. These latter are the property of the dealers.

In summer, and in cold weather whenever the temperature of the atmosphere is above 50°, the morning's milk is set in cans in a bath of water kept at boiling-point, so that the milk is brought to about 206°. It remains but a very short time. Provided there be a dozen or more cans for the hot bath and the volume of water be seven or eight times that of the milk, the can first set in is removed when the last can is put in place. The hot milk, when removed, is poured into other cans, which are immediately set in iron cisterns, through which cold water is kept running, and here the cans are kept till the evening's milk arrives. The latter is subjected to the cooling process, and in about an hour is ready for mixing with the morning's milk. This mixing is done in a circular tank having a capacity of three hundred to one thousand quarts, according to the size of the dairy. In order to a rapid and complete mixing, the morning's and evening's milk is poured in equal quantities, and at the same time, through a sort of sieve set in the middle of the tank, which stands on a wooden tripod high enough to admit of cans being placed under two large taps. These cans, for delivery, are filled as rapidly as possible. Tightly fitting covers are put on and tied down with a string sealed with the seal of the dairy, and then the milk is sent to the railway station, between 7 and 11 in the evening, in vans having lattice-work sides. The railway milk-cars are also built specially for this business, with sides and flooring of open-work.

The following is an approximate exhibit of first cost, additional expense, and net profit of the milk per gallon: First cost at the farmer's door, 10 cents; expense of collecting, heating, railway charges, delivery in Paris, wear of outfit, loss by sour milk, and debit for conversion of surplus milk into cream-cheese, 8 cents; total cost of milk, 18 cents per gallon. The average price at which the milk is delivered to the retail dealer in Paris at his place of business is 18⅝ cents per gallon, showing a profit of ⅝ cent per gallon. Some of the dealers sell over 10,000 gallons daily. It will be perceived that the calculation does not include interest on capital, expense of superintendence, and allowance for bad debts.

REPRESENTATIVE EXAMPLES.

A few suggestive examples of dairying follow. Some of them illustrate the capabilities of improved stock; others illustrate differences in feeding and cost of feeding in different sections. It is observable that in certain old dairy localities at the east the farmer's statement of account with his cows is frequently made to show little or no balance in their favor, or even a balance against them. They are credited with the cash-value of their milk-product and debited with expenses chargeable to their maintenance. In these latter is included value of home-grown food-material rated at the price it would bring on the farm. But when we remember that with this form of account, the dairy-farmer obtains a ready market at his door for his hay, grain, and roots, that he obtains manure free of cost, and that his land, steadily growing in fertility, yearly, increases his margin of miscellaneous market-crops, we are prepared to find him, as in fact we usually do, a thriving man.

At a meeting of the Littleton (Mass.) Farmers' Club, in the early part of 1874, Mr. John W. Adams reported that for the year ending February 28, 1874, he kept 13 cows, from which the product of milk during the

year amounted to 30,098½ quarts, worth at the door $1,062.30; average yield per cow, 2,315 quarts; total receipts for calves sold, $111; average gross income per cow, $90.25. Expenses: Keeping cows twenty-eight weeks, at 75 cents each per week, $273; keeping twenty-four weeks at $1.50 each, per week, $468; shrinkage, $10 each, $130. Total expense, $871, leaving a total net profit of $302.30, averaging $23.25 per cow. The manure was accounted as paying for care of the cows. Mr. Adams thought that his herd compared favorably with most of the herds in the town. His practice in winter-feeding is as follows: He milks at 5 o'clock in the morning, and after milking feeds to the cows what hay they will eat; then waters and gives three quarts of shorts and one quart of cotton-seed meal or Indian meal, after which the cows are left till 3 p. m. He then repeats the course of feeding and watering, and milks at 5 o'clock p. m.

At the same meeting, Mr. Levi Conant stated that during the last ten years he had kept on an average five cows yearly; the gross income (not including value of manure) had averaged about $90 per year. According to his calculation, this was not more than the cost of keeping, and the profit lay in the manure, which went to increase the fertility of the farm. Mr. A. H. Kimball said that the average number of his cows for the year ending February 28 was 17, and he calculated the expenses at $97.03 more than the receipts.

The statement of Mr. J. P. Eaton, of Auburn, Mass., for his herd of 16 cows, indicates an average for the year of 2,738 quarts per cow; he feeds twice a day, and cards regularly. Has a warm barn; waters in the barn. The morning's feed for cows in milk consists of 2 quarts of Indian meal, 4 quarts of coarse shorts, and 6 pounds of good early-cut hay, and the evening's feed is the same except that cotton-seed meal is substituted for the Indian meal. A tablespoonful of butter-salt is given with the grain ration; cows not in milk receive only the dry hay ration, 12 pounds per day. His cows go dry 10 weeks, as a rule, and he considers this rest as being conducive to the largest flow of milk for a term of years.

Mr. T. E. Whiting, of Concord, Mass., states that his Dutch heifer Susan, in one hundred and seventy-eight days ending September 30, 1874, gave 8,286 pounds of milk. Her feed during the first six weeks was hay, with three pecks of turnips daily; since then, pasture and two quarts of Indian meal daily. Calculated at 2.1875 pounds per quart, the stated weight of milk would measure about 3,788 quarts.

The New Hampshire Mirror and Farmer says that a grade Durham cow, six years old, belonging to Mr. E. P. French, of Bedford, in that State, gave 1,915 quarts of milk in seventy-five days, ending July 31, 1874, averaging 25½ quarts per day. During the first twenty-five days of August she gave 579 quarts, averaging 23 quarts per day. Total yield for one hundred days, 2,494 quarts, averaging very nearly 25 quarts daily. She was kept up during the entire summer, and received, besides fodder-corn and other green feed, two feeds daily of wheat-screenings ground in equal proportion with corn, about 2½ quarts at each feed. She is a large cow, girthing 6 feet and 9 inches, and her milk is of fine quality.

A milk farmer of West Cornwall, Conn., states that in 1872 his dairy of 23 cows gave an average of 2,150 quarts each. The best cow gave 3,636 quarts. The milk was sold at 4 cents per quart.

Mr. G. S. Miller, of Madison County, New York, states that his Holstein cow, Crown Princess, calved September 21, 1873, and during the three hundred and sixty-five days following, gave 12,373 pounds of

milk. Calculating the weight per gallon at 8.75 pounds, this would show a total of 1,414 gallons, or an average of very nearly 15½ quarts daily. The record of Crown Princess, for former years, appears in the report of the Department for 1873, page 252.

A statement on the herd of Mr. O. S. Tanner, of Marengo, Ill., offered at the annual meeting of the Northwestern Dairymen's Association, in February, 1874, showed a yield of 288,491 pounds of milk from 40 cows in 1873, averaging, per cow, 7,212 pounds, which, if calculated at the standard of 8.75 pounds per gallon, would be equivalent to 824 gallons. He received for the milk, at a butter-factory, $3,225.98, averaging $80.64 per cow; $60 were also received for calves, increasing the average to $82.14.

Mr. E. Seward, of Marengo, said, at the same meeting, that the statements of experience and success in feeding made by Mr. W. C. White, before the association in 1870, had put $1,500 in his pocket. Before that time he had been receiving about $30 per cow, annually, and had been satisfied with that. After hearing Mr. White he adopted higher feeding, and received, in 1871, about $70; in 1872, $72, and in 1873, $80 per cow for milk sold to a butter-factory, calves fed on sour milk, and pork properly credited to sour milk. The milk was sold at an average of one cent per pound, and the quantity of sour milk returned to him was four-fifths that of the fresh milk delivered. His dairy is a winter one, the cows calving in the fall. He gives each cow about $15 worth of feed, besides coarse fodder, hay, and corn-stalks.

We reproduce in substance the remarkable record of Sibyl, a seven-eighths Jersey and one-eighth Ayrshire cow, belonging to Mr. Henry Salstonstall, of Peabody, Mass. She calved April 7, 1868; and during the year ending April 7, 1869, gave 13,005 pounds of milk. Allowing 8.75 pounds per gallon as the average weight of the milk, (a large allowance, since Jersey milk is generally richer and lighter in weight than other milk,) this product would be equivalent to 14.86$\frac{2}{7}$ gallons. Her yield decreased gradually from he largest flow, which was soon after calving, falling off to about 40 per cent. of that maximum during the last month of record. Her feed in summer was old upland pasture, with cut corn-fodder in August, at night. She received a little grain between grass and root time, about one bushel in all, and in winter had what hay she would eat clear and a peck of roots daily. She calved again April 14, 1869. She was dried off about the middle of July by tying her up in the stable and feeding her on a small ration of dry hay. Sibyl was bred by Mr. Thomas Motley, of Jamaica Plain, Mass., a well-known breeder of Jersey stock. Her weight for 1868–'69 is given at 950 pounds.

The following particulars are from a statement by Mr. W. S. Tilton, of Maine, giving the yield of his herd of 20 cows for the year ending October 23, 1873. Eight of the herd were Jersey, ten were cross-breeds, and two were Holstein:

Averages.	Holstein.	Cross-breeds.	Jersey.
Average number of days in milk	325	298	322
Average product per cow, (pounds)	6,960	4,435	3,901
Average yield per day while in milk, (pounds)	21.41	14.88	12.11
Average yield per day for the year, (pounds)	19.06	12.15	10.68
Average percentage of cream	12.50	13.35	21.67

The cows had little or no feed except hay in winter. In summer they were kept on poor pasture, with fodder-corn at night. The motive for not keeping them high was that their lacteal powers should not be overtaxed, as they were all breeders, too valuable to be held merely for dairy purposes.

A correspondent of the Country Gentleman, in Westchester County, New York, who grows milk for the market of New York City, states the average yield of milk per cow of his herd from 1867 to 1873, inclusive. During that period the herd contained 55 different cows; at the time of the report it numbered 26.

The statistics are given in the following table:

Year.	Average number of days of milking-season.	Average annual yield per cow.	Average daily yield per cow.	Average price per quart for the season.	Average annual amount received per cow.
		Quarts.	*Quarts.*	*Cents.*	
1867	270	2,460	9 1-9	5⅛	$126 07
1868	274	2,432	9	4¾	115 52
1869	271	2,433	9	4¾	115 46
1870	276	2,295	8⅓	4¾	109 00
1871	270	2,397	8 4-5	4½	106 86
1872	268	2,060	7⅝	4	82 40
1873	273	2,570	9½	4	102 80
Total average	271	2,381	9	4½	107 15

The tenor of the report indicates "native" stock, and grades from Canada. Of the latter he says: "The best stock I have in respect to hardiness of constitution, abundant and sustained flow of milk, together with quality when they come to the block, are the improved Canada, so called. Several of these, purchased nine years ago, now eleven years old, still hold their own." The record of his Canada cow, Eppie, eleven years old, exhibits the following averages for the entire period of seven years: Average length of milking-season, 270 days; average annual yield, 4,380 quarts; average daily yield during the milking-season, 16¼ quarts; average annual amount received for milk, $175.20. His schedule of winter-feed includes corn-meal, at $35 per ton, wheat-bran, at $25 per ton, hay, at $20 per ton, cotton-seed meal, at $32 per ton, corn-stalks, at $3 per one hundred sheaves, brewers' grains, and a few turnips. According to tables presented by him, 3 cents was the approximate cost of the feed required, in his practice, to the production of one quart of milk in winter. He adds that much of the pasture-land in his vicinity is worth $200 per acre, and that the practice of growing corn for summer fodder is becoming more general in that section.

FEEDING FOR BUTTER AND CHEESE.

At the Connecticut farmers' convention, in December, 1874, Dr. E. L. Sturtevant presented a paper on "Milk as affected in the butter and cheese product by the feed," a subject which has of late been much discussed by European and American experimentalists. The following points are especially worthy the attention of dairymen: 1. The butter-product is largely governed by food. 2. There is a structural limit to the butter-capacity of each cow. 3. When the cow is fed to this limit, increased food cannot increase the product. 4. The superior cow has

this structural limit at a distance from ordinary feed, and more readily responds to *stimuli* than the inferior cow. 5. The superior cow is seldom fed to her limit, while the inferior one may be fed beyond her limit. 6. The character of the food has some influence on the character of the butter, but breed has more.

An illustration of the advantage of attention to the individual peculiarities of cows in respect to feeding is given by a correspondent of the Boston Cultivator, in relating his experience with two cows. One of these came in milk in June, when three years old, and gave a fair quantity of milk till winter, when, having no feed but hay, she began to fall off. In order to keep up the flow he bought a quantity of small potatoes, at 25 cents a barrel, and began feeding them at the rate of one-half peck daily, and, as this feed was found beneficial, the quantity was afterward increased to a peck daily. This treatment increased and maintained the flow of milk without impairing its quality. She was dried off about six weeks before coming in, and after this time of drying off she was fed a quart of dry meal daily. This course was continued for three winters with similar results. The fourth winter, instead of the potatoes, she received at first a pint of meal daily, and this causing no increase of flow, the quantity of meal was increased to two quarts daily. With this ration there was a decrease in amount of milk and an increase in flesh. All the stock of this cow were affected in a similar manner by feeding potatoes or meal. Afterward he had a cow one-half Devon and one-half native, an excellent animal. Her flow of milk was not increased by potatoes, and the quality of the milk was somewhat depreciated by them. But meal, fed either dry or wet, increased and sustained the flow. These characteristics manifested themselves in all her stock.

ANIMAL FAT IN BUTTER AND CHEESE.

Considerable interest has recently been aroused regarding the use of animal fat in manufacturing artificial butter and in cheese. In making suet-butter, as it is often called, the fresh fat of slaughtered beeves goes through certain processes of preparation, and is finally churned with buttermilk or common milk, the use of cream being thus dispensed with. When the fat is of good quality and skillfully handled, the churning turns out an article which, though not able to compete with really good butter, may serve well as a substitute for the flavorless or ill-flavored qualities with which the market is so largely furnished. A late report of a special committee of the New York Butter and Cheese Exchange says that no objection can be made to the sale of this suet-butter under its proper designation, but advises the trade to guard watchfully against its introduction as pure butter, whether alone or in mixture with the true dairy-product.

More recently, oleo-margarine, or prepared fat, has been applied in combination with skimmed milk, to the making an imitation of full milk-cheese, the entire cream being employed for butter. An editorial in the Utica Herald of November 10, 1874, gives an account of a visit to an establishment at McLean, Tompkins County, New York, in which such cheese is manufactured, under patent. The writer states that the proprietors obtain the fat from a reliable factory in Brooklyn, and that the material is heated slowly in deep pails, set in a water-bath, until it is fully melted, when it becomes an oil of a fine golden color. The temperature of the skim-milk in vat has mean time been raised to 92°, a few degrees lower than the temperature of the heated oil. The latter is then

poured through a tin strainer upon the milk, and the contents of the vat are stirred quickly, the heat being at the same time carried to about 94°. Sufficient rennet is added to produce coagulation in eight or ten minutes, and two assistants stir the milk during this intervening time, in order to secure an intimate combination of the oil and milk in the forming curd. That portion of the oil which is not taken up by the curd is skimmed from the surface of the vat, the curd sinking to the bottom. A microscopical examination of curd of this description, forty-eight hours old, showed that the oil-globules were much larger than in the usual whole-milk curd, and that they were not so intimately and evenly distributed throughout the curd-mass. About 3,000 cheeses made by this process were found at the factory, and many of these were tested. While these did not exhibit the flavor of fancy cheese, the writer pronounced them to be, in marketable qualities, above the average of the full-milk cheese which he had inspected during the season. A longer time appears to be allowed for curing than in the case of full-milk cheese. The milk is purchased from neighboring farmers in the following manner: Ten pounds of milk are reckoned as equivalent to one pound of cheese, for which the farmer receives "the highest New York quotations, less two cents," thus obtaining an increase in price of milk. It is stated that the process is about to be introduced into other sections of the country.

The dangers of depreciation of quality and reputation attending the introduction of this new material into dairy manufactures will readily be perceived. It remains to be seen whether, with such substitution of material to any considerable extent, the advantages would more than counterbalance the disadvantages which would arise.

FARM EXPERIMENTS.

MANURING FOR POTATOES.

The following is an abstract of experiments by Mr. C. D. Hunter, of Cumberland, England, in growing potatoes during consecutive years on the same land, a light soil, with only one application of the named fertilizers. Plot 1 was not manured; plot 2 received superphosphate; plot 3, superphosphate and potassic chloride; plot 4, superphosphate and ammonic sulphate; plot 5, superphosphate, ammonic sulphate, and potassic chloride; plot 6, superphosphate, ammonic sulphate, potassic chloride, and magnesic sulphate. The results for three years are tabulated in bushels of 56 pounds, showing yield per acre and the gain per acre of manured over unmanured soil:

Plot.	1868.		1869.		1870.	
	Yield.	Gain.		Gain.		Gain.
1	236.8	....	188.4	....	128.4	....
2	286.0	49.2	202.8	14.4	161.6	33.2
3	297.2	60.4	267.2	78.8	270.0	141.6
4	....	....	215.6	27.2	180.8	52.4
5	....	....	364.0	175.6	326.4	198.0
6	....	....	328.0	139.6	298.0	169.6

Potash increased the size of the tubers and the aggregate yield, and there was less falling off of the crop in consecutive years. It was found that chloride of potash could not be replaced by either common salt or kainit. In accordance with the exhibit of plot 5, Mr. Hunter recommends to be applied to potatoes, without dung, the following mixture per acre: Superphosphate of lime, 728 pounds; muriate of potash, 280 pounds; ammonic sulphate, (sulphate of ammonia,) 280 pounds.

The Boston Journal of Chemistry gives an analysis of the fertilizer, assuming that the superphosphate contains 16 per cent. of soluble phosphoric acid, the muriate of potash 85 per cent. of potassic chloride, and the ammonic sulphate 95 per cent. of the pure salt. The analysis stands: Phosphoric acid, 9.05 per cent., potassium, 9.68 per cent., ammonia, 6.84 per cent. The cost of the mixture in this country would be, at the best rates, about $67.17 per ton, and at these figures the cost of manuring one acre would be $43.26. But in the given experiment one application of the fertilizer resulted in a gain during two years, over the product of the unmanured soil, of 373.6 bushels of potatoes per acre, which, at 50 cents per bushel would amount to $186.80.

For purposes of comparison see Department Report for 1870, page 461, for experiments as to the effect of superphosphate and potash salts on light sandy soils, and on clays; also page 460 as to the best time for applying such fertilizers.

SIZE AND QUANTITY OF SEED.

Mr. J. H. Scovel, of Paris, Oneida County, New York, reports an experiment in planting potatoes in 1873. The soil was a clay loam, and had been well manured in the preceding season with rotted barn-yard manure and planted for fodder-corn. The plowing in preparation for potatoes was done early in May, and the planting was commenced May 21, in rows 3 feet apart, the hills 2 feet and 9 inches apart in the rows. One row containing seventy-five hills was appropriated to each method of planting, exhibited in the following table. The variety planted, was, except where stated, the "Oneida Peachblow," a seedling of the Garnet Chili, and preferred by Mr. Scovel to the latter. It originated in that vicinity, and is well adapted to the locality, which has an elevation of about 1,500 feet above the level of the sea. The cuttings of the first nine rows were rolled in plaster, and on the remaining rows, except in plot 10, a tablespoonful of plaster was thrown on the potatoes in the hills before covering. The subsequent treatment was that of ordinary field-culture. The potatoes were dug October 14 and 15. Plots 10 and 13 gave the largest yield of marketable potatoes, and the former the largest total. The second largest total yield was on plot 21 where each hill had been planted with the eyes of one potato in separate pieces, but nearly a quarter of the yield in this case was below a marketable size. The yield per acre is given in bushels of 60 pounds each:

Plot.	Quantity of seed per hill.	Seed per acre. Bushels.	Product per acre. Bushels.		
			Large.	Small.	Total.
1	One eye to a piece, and one piece in a hill	2.33	136.25	....	136.25
2	One eye to a piece, and two pieces in a hill	6.00	189.00	7.00	196.00
3	Two eyes to a piece, and one piece in a hill	6.00	191.50	10.00	201.50
4	Two eyes to a piece, and two pieces in a hill	12.33	257.00	16.00	273.00
5	Three eyes to a piece, and one piece in a hill	8.20	214.00	7.00	221.00
6	Three eyes to a piece, and two pieces in a hill	15.83	259.67	14.00	273.67
7	Four eyes to a piece, and one piece in a hill	11.80	232.50	14.50	247.00

Plot.	Quantity of seed per hill.	Seed per acre. Bushels.	Product per acre. Bushels. Large.	Small.	Total.
8	Four eyes to a piece, and two pieces in a hill	21.17	295.00	17.50	312.50
9	Five eyes to a piece, and one piece in a hill	14.00	258.50	16.50	275.00
10	One large potato	43.50	305.50	43.50	349.00
11	One large potato, cut in two lengthwise, one piece in a hill	21.17	263.00	20.00	283.00
12	One medium potato	25.25	289.00	18.80	307.80
13	One medium potato, divided, two pieces in a hill	27.00	300.00	27.00	327.00
14	One medium potato, cut twice, four pieces in a hill	28.20	269.00	33.00	302.00
15	One medium potato, cut in two, one piece in a hill	15.25	262.00	12.00	274.00
16	Seed end	10.50	259.50	10.00	269.50
17	Stem end	21.17	289.00	20.00	309.00
18	One small potato	11.83	250.25	23.00	273.25
19	One small potato, divided, two pieces in a hill	11.83	272.50	16.50	289.00
20	One small potato, divided, one piece in a hill	6.50	230.20	8.20	238.40
21	One medium potato, cut to single eyes	30.50	262.00	70.50	332.50
22	One good sized potato, eyes dug out, 30 hills missing	33.00	134.00	16.50	150.50
23	Garnet Chili, one good-sized potato, eyes dug out, 22 hills missing	35.25	155.50	10.50	166.00

Seventy-six hills, each planted with the parings of a single potato, pared quite thick, yielded at the rate of 183.25 bushels of marketable potatoes, and 38.75 bushels of small potatoes per acre. These hills were throughout the season later and less vigorous in their growth than those planted with seed cut in the ordinary manner. Seventy-four hills were planted with the pared potatoes; of these only ten hills gave a product. This consisted of 19 potatoes of late growth, weighing 11 pounds. Mr. Scovel remarks that in field-culture it has been his practice to use for seed medium-sized but well-developed tubers, generally planting them whole; when larger he divides them lengthwise before planting.

FERTILIZING COTTON.

Professor E. M. Pendleton, of the University of Georgia, in a late report, states the following experiment, made on thin soil formed by the disintegration of an underlying micaceous slate, which crops out largely in the neighborhood. This soil had been under cultivation for a number of years. Furrows were opened with a turning-shovel, and rows were laid out seventy yards long; to one row was applied one bushel of fresh dung, placed in the furrow and bedded over; to another row was applied in like manner one bushel of old rotted manure; at planting, 100 pounds per acre of superphosphate of a high grade were put in with the seed in these rows. Another row was left unmanured. The latter yielded at the rate of 457 pounds of seed cotton per acre. The row which had received fresh stable-manure and superphosphate yielded 903 pounds of seed-cotton per acre, and the row which had received rotted dung and superphosphate yielded 892 pounds of seed-cotton per acre. On soil of the same description two rows were laid out seventy yards long. The treatment of these rows differed in this respect, that in one row 30 bushels per acre of green cotton-seed were buried deeply with a turning-shovel, while the other row received the like amount of cotton-seed in which the germ had been killed. In each case 100 pounds per acre of superphosphate were applied at time of planting. In the case of the green cotton-seed little of it came up, showing little loss of nitrogen. Another row was left unmanured, and yielded at the rate of 435 pounds of seed-cotton per acre. Where the green cotton-seed was applied the yield per acre was 885 pounds; net profit per acre, $12. With the other application the yield was 915 pounds per acre; net profit per acre, $13.30.

SHALLOW AND DEEP PLOWING.

Professor W. W. Daniells, of the University of Wisconsin, reports on experiments made yearly from 1871 to 1873 inclusive, in regard to depth of plowing on land lying low and nearly level, and possessing a clay soil with stiff clay subsoil. Four plots were experimented upon, each containing one acre. Plot 1 was plowed 5 inches deep; plot 2, 12 inches deep; plot 3 was trench-plowed in 1871, 12 inches deep; in 1872 and 1873, 17 inches deep; plot 4 was plowed and subsoiled in 1871, 16 inches deep; in 1872 and 1873, 17 inches deep. There was a slight descent of ground from the shallow-plowed to the deeply-plowed plots, and there was no drainage except over the surface. The land had been yearly cropped in corn; the cultivation of the plots was similar. The following is a presentation of results, showing the yield per acre of corn in the ear, in bushels of 75 pounds each:

Plots.	Method of plowing.	1871.	1872.	1873
1	Plowed 5 inches deep	55.40	43.52	53.40
2	Plowed 12 inches deep	50.65	50.32	52.80
3	Trench-plowed, 12 to 17 inches deep	44.95	54.74	51.30
4	Subsoiled, 17 inches deep	42.21	56.77	51.10

Professor Daniells remarks that in 1871 the shallow-plowed plot had an advantage over the others, where the heavy clay subsoil had been mixed with the soil. All the plots were plowed in the fall of 1871 and again in the spring of 1872. Soil and subsoil had then become well mixed, and the subsoil, by exposure to frost and air, had become well pulverized; disintegration was aided by the addition of 60 bushels of unleached wood-ashes in the spring of 1872. In that year the season was very dry, and the deeply-plowed plots did the best, being better able to withstand drought than the shallow-plowed land. In 1873 rain fell on eleven days in the latter part of June and the first part of July, giving a total rain-fall of 5 inches. Owing to the situation of the deeply-plowed plots and the want of drainage, as already mentioned, these plots were saturated with water to such an extent that the growth of the corn was seriously interfered with. Drains have been laid since these experiments.

The superintendent of the Kansas Agricultural College farm reports an experiment on 2.95 acres of upland prairie, which had been inclosed and pastured for a course of years, and from which a hay-crop had been taken in the preceding summer, amounting to not more than one-third of a ton per acre. The field was divided into six plots, varying in size from .384 acre to .682 acre. Plots 4, 5, and 6 received a dressing of fresh stable-manure, applied in winter and spring before plowing. Plots 1 and 6 were broken in the usual way, 2 to 3 inches deep. Plots 2 and 5 were trench-plowed in addition to this breaking; that is to say, a common turning-plow followed the breaker and threw about 4 inches of soil over the inverted sod. Plots 3 and 4, in addition to the plowing received by plots 2 and 5, were subsoiled, the subsoiler following the turning-plow and merely loosening the soil to the depth of 10 to 15 inches. The land was harrowed with the Thomas harrow, and planted immediately with College Yellow Dent corn, May 31, 1873. Cultivators were run through the rows during the season to keep the surface loose and open. The season was an unusually unfavorable one. The corn stood the drought well, and was cut and shocked early in September, and husked in October,

both grain and stalks being very dry. The following table gives results in shelled corn.

Plots.	Preparation of soil.	Bushels per acre.			Pounds of stalks per acre.
		Hard corn.	Soft corn.	Total.	
1	Common breaking alone	5.68	1.86	7.54	1,000
2	Common breaking and trench-plowing	6.94	2.73	9.67	1,405
3	Same as in plot 2, with subsoiling	12.24	1.14	13.38	1,658
4	Same as in plot 3, with manure	16.48	.76	17.24	1,224
5	Same as in plot 2, with manure	14.84	.43	15.28	1,816
6	Same as in plot 1, with manure	9.11	.81	9.92	1,026

Attention is called to the greatly reduced proportion of soft corn and the larger proportion of corn to stalks on the manured plots.

WHEAT EXPERIMENTS AT ROTHAMSTED, ENGLAND.

Mr. Lawes reports results for the season of 1874, in continuation of the wheat experiments at Rothamsted. [See abstract of the experiments for 1852–'73, in Department report for 1873, page 295.] The product of the continuously unmanured plot for 1874 was 11½ bushels per acre, very nearly the same quantity as in 1873, and 2½ bushels per acre below the average of twenty-three years. The land dressed with 14 tons of farm-yard dung per acre yearly, gave 39¼ bushels of 60¼ pounds each, per acre, or 12½ bushels per acre more than the yield of 1873, and nearly 4 bushels more per acre than the average for twenty-three years. Continuing to consider one acre of land as being represented in each case, plot 7, manured with a mixture of mineral fertilizers and ammonia salts as heretofore described, gave 39½ bushels, substantially the same in amount as the product from the farm-yard dung, and 17½ bushels more than was obtained from this mixed manure in 1873, and 4 bushels more than the average from the same application for twenty-three years. Plot 8, receiving the like application with plot 7, but larger in amount, has yielded in favorable seasons a considerably larger amount of grain and straw; but in 1874, while giving 12 cwt. to 13 cwt. more of straw than plot 7, it yielded only one bushel more of grain.

Plot 9 which has been manured yearly with nitrate of soda in the spring, gave more straw but about one bushel less of grain than plot 7, which had received ammonia salts in autumn. On the other hand, in 1873, the former plot, with its application of nitrate of soda in spring, yielded nearly 14 bushels more than the latter plot with ammonia salts in autumn. The inferiority of plot 7 in 1873 was owing to the unusually wet winter of 1872–'73 and consequent loss of ammoniacal salts by drainage. During the dry winter of 1873–'74, there could have been but little loss from this cause.

SELECTION OF SEED.

The experiments of Maj. F. F. Hallett, of Manor Farm, Kemptown, England, in the selection and planting of seed have attracted much attention among agriculturists in that country. In a paper read by him

before the Midland Farmers' Club, at Birmingham, June 4, 1874, he says:

The plan of selection which I pursue is as follows: A grain produces a plant consisting of many ears. I plant the grain from these ears in such a manner that each ear occupies a row by itself, each of its grains occupying a hole in this row, the holes being twelve inches apart every way. At harvest, after the most careful study and comparison of the plants from all these grains, I select the finest one, which I accept as a proof that its parent grain was the best of all, under the peculiar circumstances of that season. This process is repeated annually, starting every year with the proved best grain, although the verification of this superiority is not obtained until the following harvest.

In illustration of these principles of selection, I now give the following results, due to their influence alone—as the kind of seed, the land, and the system of culture employed were precisely the same for every plant for four consecutive years; neither was any manure used, nor any artificial means of fostering the plants resorted to.

Table showing the importance of each additional generation of selection.

Year.	Selected ears.	Length.	Containing.	No. of ears on finest stool.
		Inches.	*Grains.*	
1857	Original ear	4⅜	47	....
1858	Finest ear	6¼	79	10
1859	Finest ear	7¾	91	22
1860	Ears imperfect from wet season	....	....	39
1861	Finest ear	8¾	123	52

Thus, by means of repeated selection alone, the length of the ears has been doubled their contents nearly trebled, and the "tillering" power of the seed increased five-fold.

The following table gives similar increased contents of ear obtained in three other varieties of wheat.

Varieties of wheat.	Grains in original ear.	Grains in improved ear.
Original red, commenced 1857	45	123
Hunter's white, commenced 1861	60	124
Victoria white, commenced 1862	60	114
Golden drop, commenced 1864	32	96

It was supposed by the ancient writers that the powers of grains differed in relation to their positions in the ear. This I investigated in 1858 by planting the grains of ten ears on a plan showing their several positions in the ear. The only general result, among most conflicting ones, was that the smallest corns—those most remote from the center of growth—exhibited throughout, most unexpectedly, a vigor equal to that of the largest; and that the remarked worst grains, in one or two instances, did not by any means fall so far short of the good ones as had been expected. I have also made frequent trials of the comparative power of large and small, plump and thin grains; and, in the case of oats, which produce a small grain attached to a large one, trials as to their respective powers, with uniformly the same result, viz, that in good grains of the same pedigree, neither mere size nor situation in the ear supplies any indication of the superior grain.

Very close observation during many years has led me to the discovery that the variations in the cereals which nature presents to us are not only hereditary, but that they proceed upon a fixed principle, and from them I have educed the following law of development of cereals:

1. Every fully-developed plant, whether of wheat, oats, or barley, presents an ear superior in productive power to any of the rest on that plant.
2. Every such plant contains one grain which, upon trial, proves more productive than any other.
3. The best grain in a given plant is found in its best ear.
4. The superior vigor of this grain is transmissible in different degrees to its progeny.

5. By repeated careful selection the superiority is accumulated.

6. The improvement, which is at first rapid, gradually, after a long series of years, is diminished in amount, and eventually so far arrested that, practically speaking, a limit to improvement in the desired quality is reached.

7. By still continuing to select, the improvement is maintained, and practically a fixed type is the result. * * * *

The superiority of some individuals over others is so marked in various ways as to lead irresistibly to the inference that it must be hereditary. * * * Upon this great principle, running throughout all nature, I base my system of selection. The results of selection in many agricultural plants, such as the parsnip, cabbage, turnip, potato, hop, &c., are well known; and there has recently been published in France a report showing how my principle of selection, applied to the beet cultivated for sugar, has resulted in an increase of 5 per cent. of sugar. In the case of the vine, too, I may cite an instance: Some eight years since I communicated to an Italian friend my views as to the selection of the vines. These he carried back with him to his relative in Piedmont, and two years ago he informed me that the produce in wine from his relative's estate had been trebled by adopting the principle of selection.

Major Hallett insists strongly on thin sowing of wheat. It is to be remembered that he is speaking of practice on English soil, in good heart, kept clean, and thoroughly tilled. He urges that it is necessary to the full vigor and greatest product of the plants that they be sown early, giving each plant sufficient room to develop itself completely, by tillering freely, and occupying its just measure of ground. He recommends for large fields of wheat that planting take place from the last of August to September 10, using two gallons to three gallons of seed per acre. When circumstances delay planting beyond this period, an additional gallon of seed, per acre, should be used for every week of delay up to the end of September. Early planting gives advantage in saving of seed, in forwarding the fall work of the farm, in enabling the plants more effectually to resist the lifting of winter frosts, and in an earlier harvest.

In illustration of the vigor of grains grown by him, he states that at the Exeter meeting of the British Association he exhibited three plants of wheat, barley, and oats, each from a single grain, showing the following number of stems, respectively: wheat, 94; barley, 110; oats, 87. As to the effect of the increased size of the grains on the aggregate of the crop, he adds that he has found one bushel of his pedigree wheat, (original red,) produced from single grains planted 12 inches by 12, to contain about 460,000 grains; a bushel of ordinary wheat containing 700,000 grains. The enlargement of the grains tends to a proportional increase in measured yield. On three acres of land he has averaged 72 bushels of wheat per acre from a seeding of one-third of a bushel per acre, and on an entire field of barley he has averaged, per acre, 82 bushels, weighing 57 pounds per bushel, from a seeding of one peck per acre.

In respect to regularity of drill, Major Hallett says:

My principal object is to insure perfect singleness and regularity of plant with uniformity of depth. The two latter may be attained by the drill, as may the former also, by adopting the following plan: The seed-cups ordinarily used in drilling wheat are so large that they deliver bunches of grains, consisting of six or seven, which fall together within a very small area, from which a less produce will be obtained than if it had been occupied by a single grain. The additional grains are thus not only wasted, but are positively injurious. By using seed-cups, however, which are only sufficiently large to contain one grain at a time, a stream of single grains is delivered, and the desired object, viz, the depositing of grains singly, at once attained. The intervals in the rows will not be exactly uniform, but they will be sufficiently so for all practical purposes. The width of these intervals will, of course, depend upon the velocity with which the seed-barrel revolves, which can be regulated at pleasure by a proper arrangement of the cog-wheels which drive it. By drilling thus we obtain the advantage of the "broadcast" system, also equal distribution, as we can have the rows as close together and the grains as thin in the rows as we please.

The crop should be hoed as soon and as frequently as practicable, with Garrett's horse-hoe. If the seed has been sown early, this should be done in the autumn, as it causes the plants to tiller and occupy the whole ground before the winter sets in. It is essential to the success of thin sowing, to keep the land perfectly free from weeds during the growth of the crop.

American farmers may thus see what has been attained in England, and adapt the lesson to their own practice. The principles involved are clearly set forth; the application, particularly in respect to quantity of seed and time of sowing, must be modified by regional and local peculiarities. In this country we are obliged to forego in some degree the advantages of early planting of wheat, in order that the plant may avoid the ravages of the Hessian fly.

ENGLISH EXPERIMENTS ON PERMANENT PASTURE.

Professor Voelcker reports on results of experiments on permanent pasture from 1868 to 1871, inclusive. These were in continuation of those given in the report of this Department for 1869, pages 276 to 279; and substantially the same fertilizers were employed as are there mentioned, namely, per acre for each field of experiment; on one plot, 100 bushels of quicklime; on another, 100 bushels of quick-lime and 560 pounds of salt; on another, 1,680 pounds of fine bone-dust; on another, 560 pounds of mineral superphosphate and an equal weight of crude German potash salts; on the next plot, no manure; on another plot, 560 pounds of salt alone; on another, 560 pounds of Peruvian guano; on another plot, 560 pounds of crude German potash salts, alone; on another, 560 pounds of mineral superphosphate and an equal weight of Peruvian guano; on the next plot, no manure.

On one of the soils, which proved to be deficient in lime, the application of that article gave a good increase of grass, as did also the bone-dust. But in most of the cases the lime had no beneficial effect. Professor Voelcker advises farmers to be cautious about incurring large expense in applications of bone-dust before a limited trial of its effect on their land. On some soils, especially on poor, light pasture, this application has had a wonderful effect. But on cold clay pasture-land money has frequently been wasted in bone-dust; on such land it has been found much better to top-dress pasture with a mixture of superphosphate, potash salts and guano, or nitrate of soda, than to dress largely with bone-dust. Much difficulty is encountered in attempting to prescribe manurial compounds for pastures, on account of the great variation in the composition and physical character of their soils. But, generally speaking, the best manures for grass-land are those that are rich in nitrogen and readily available phosphoric acid.

Professor Voelcker concludes by remarking that applications of artificial manures on permanent pasture often result in pecuniary disappointment, and, as a rule, no artificial manurial mixture gives so favorable a return as good farm-yard manure. He believes that in English practice it would be profitable for the farmer to apply the larger portion of his yard-manure to his pasture-land rather than to the arable land, since he can readily secure a pecuniary profit with artificial manures on roots and cereal crops.

SHELTERED AND UNSHELTERED MANURE.

Lord Kinnaird, in a letter to the Scotsman, states the following experiments in comparing the effect of dung which had been kept under

cover with that of unsheltered dung. The soil was a rich loam, lying on trap, and the field was planted in potatoes. One acre treated with sheltered manure yielded 11 tons, 17 cwt., 56 pounds of potatoes, and another acre fertilized with like manure, 12 tons, 12 cwt., 26 pounds of potatoes; average of two acres, 12 tons, 4 cwt., 97 pounds. One acre dressed with unsheltered manure yielded 7 tons, 6 cwt., 8 pounds of potatoes, and another, treated in like manner, yielded 7 tons, 18 cwt., 99 pounds; average of two acres, 7 tons, 12 cwt., 53½ pounds. Gain in product of potatoes per acre, from application of sheltered manure, 4 tons, 12 cwt., 43½ pounds.

A similar trial was made on wheat the next year. But the season was characterized by wet weather, and the grain was soft and not in very good order. Two acres dressed with unsheltered manure yielded, of wheat, weighing 61½ pounds per bushel, respectively, 41 bushels, 19 pounds, and 42 bushels, 38 pounds. Two acres dressed with sheltered manure yielded, of wheat, weighing 61 pounds per bushel, respectively, 55 bushels, 5 pounds, and 53 bushels, 47 pounds. Average excess of product of wheat per acre, from the application of sheltered manure, 12¼ bushels of 60 pounds. Average of straw per acre from sheltered manure, 2.36 tons; from unsheltered manure, 1.72 tons, showing an excess of .64 ton from the former application.

NITRIFICATION OF VEGETABLE SOIL.

In recent experiments by M. Boussingault on the nitrification of a vegetable mold in confined, unrenewed, stagnant air, it was shown that under such conditions the nitrogen of the atmosphere takes no part in the nitrification, which is accomplished at the expense of nitrogenous organic matter.

FERTILIZING WITH CLOVER.

At a meeting of the Connecticut Board of Agriculture, in December, 1873, Mr. Willard stated an experiment illustrating the action of clover. He had six acres of very fine clover on a gravelly loam of medium heaviness, underlaid by red sandstone—the soil substantially equal in character throughout the field. As soon as the clover was in blossom he mowed about one-half of the field. A rainy season followed, and the aftergrowth grew luxuriantly, and in August he cut about one acre the second time. He then plowed the whole field and seeded to rye. The crop of rye appeared to be the same throughout the field, and he observed that where the clover had been mown the soil was full of small fibrous roots, but where the clover had not been mown, the amount of roots was not as large.

ADAPTATION OF PLANTS TO SOILS.

Of two nearly allied kinds of plants grown on the same soil, one may not thrive while the other may be quite vigorous; yet the former may succeed in a neighboring locality and on an apparently similar soil. The following is an abstract of recent French experiments with the cluster pine and other pines for the purpose of a better understanding of the causes of such differences: Three lots of soil were taken, including subsoil. Number 1 consisted chiefly of quartz sand, and in this *Pinus pinaster* throve well. Number 2, from the vicinity, contained more lime, especially in the subsoil; in this *P. pinaster* did poorly, while *P. silvestris* and *P. laricio Austriaca* grew well. In number 3, containing more lime both in the upper soil and the subsoil, only the two latter species made a growth. The differences in the growth of the cluster pine are attributed to a non-assimilation of potash by that plant in the lime soils.

FEEDING BUCKWHEAT-BRAN FOR MILK.

The superintendent of the Eastern Pennsylvania Experimental Farm reports experiments in comparing the values of wheat-bran and buckwheat-bran for the production of milk. During the first trial, commencing January 28, 1874, sixteen cows were fed with 10 pounds of cut fodder and 10 pounds of cut hay per day, in two feeds, also 5¼ quarts of Indian meal and the like quantity of wheat-bran, mixed and divided into two equal portions and fed separately from the hay-ration. The wheat-bran weighed 16½ pounds per bushel, and cost $26 per ton. The following is a statement of daily yield for seven days:

Date.	Time of milking.	Pounds of milk.	Temperature—Degrees.	Date.	Time of milking.	Pounds of milk.	Temperature—Degrees.
January 28	Morning	109	45	February	Morning	115¼	20
January 28	Evening	71	46	February	Evening	56¼	32
January 29	Morning	109	30	February	Morning	101¼	11
January 29	Evening	71	35	February 2	Evening	70	20
January 30	Morning	118¼	32	February 3	Morning	99	22
January 30	Evening	77	24	February 3	Evening	71	32
January 31	Morning	111	32				
January 31	Evening	72	31		Tota	1,252	

This shows a daily average per cow of 11.18 pounds of milk, or a little over 5 quarts. In the second experiment, lasting the same number of days, the cows were fed as in the first case, except that an equal value of buckwheat-bran, costing $20 per ton, was substituted for the wheat-bran. As the buckwheat-bran weighed 19 pounds per bushel, it would appear that 5.9 quarts were used, or 3.5 pounds, against 2.7 pounds of the wheat-bran. The following shows the yield of milk during this test:

Date.	Time of milking.	Pounds of milk.	Temperature—Degrees.	Date.	Time of milking.	Pounds of milk.	Temperature—Degrees.
February 4	Morning	103¼	22	February 8	Morning	111	20
February 4	Evening	91	29	February 8	Evening	73¼	26
February 5	Morning	99	29	February 9	Morning	105	16
February 5	Evening	76	30	February 9	Evening	78¼	32
February 6	Morning	111	15	February 10	Morning	98¼	24
February 6	Evening	77	19	February 10	Evening	77	22
February 7	Morning	107¼	19				
February 7	Evening	74	20		Total	1,282¼	

Excess of total product of milk over that of the first trial, 30.25 pounds, or nearly 14 quarts. The substitution of buckwheat-bran for wheat-bran resulted in an increased flow of milk, notwithstanding the nearer approach to the time of drying off. Analyzing the exhibit still further, and taking Indian meal at 80 cents per bushel, and hay at $16 per ton, it is found that the milk would require to have been sold at 5.5 cents per quart in order to repay the cost of feed. During the next seven days the cows received the same kinds and amounts of feed as in the second case; but the meal and bran were mixed with the hay and

fodder, and the mixture was wet with hot water twelve hours before feeding. This experiment showed an additional increase of 36.25 pounds in the aggregate product of milk for the seven days, or about 16.5 quarts, with very slight difference in the relative cost of production. Throughout the whole course of experiments, a family of two persons received enough of the new milk for their daily wants; the rest was used for butter. Quantity of butter made during the first experiment, 57.63 pounds; during the second experiment, 59.63 pounds; during the third experiment, 60.5 pounds. The precise average of milk for one pound of butter is not shown; but without any deduction for milk used in the family, the averages of milk for butter in the different trials would be, respectively, 21.7 pounds, 21.5 pounds, and 21.8 pounds.

FEEDING FOR MILK.

The following is the tenor of Professor Atwater's recent presentation of the results reached by German experimentalists in feeding for milk: The total amount of the milk, and also its amount as shown by the percentage of dry substance it contains, may, up to a certain point, be increased by feeding a rich ration. The composition of this dry substance, that is to say, its proportion of butter to caseine, is not essentially affected by the differing character of the food. As soon as the ration reaches a certain maximum, further increase of the food has no effect on the quality of the milk and only a slight effect on its quantity. In practice, therefore, true economy will not consist with a meager ration, nor with an unnecessarily large and rich one; and a judicious selection of cows is a prime requisite in carrying out the specialty of quantity of production of milk, of butter-quality, or of adaptation to cheese-making.

CURRENT FACTS IN AGRICULTURE.

Improvement in live stock.—There has been in recent years a great improvement in the exhibit of cattle at the Union Stock-Yards in Chicago, and now many of the animals are half-breeds and higher grades of the improved breeds, the majority of these being short-horns. The Texas cattle received are mostly of native stock, but their condition is much better than that of the same class formerly, feeders putting much more beef on them than they then did. These cattle are forwarded from Texas to Colorado, Kansas, Iowa, and Illinois, to be made ready for market. Some of the stock in the yards is first-class beef, thick in flesh. The writer gives a record of sales of Texan cattle in 1873, at the yards, from which we take the following particulars: Total number of Texan cattle sold in 1873, 156,990. Range of prices in January, 1873, \$2.25 to \$4.75; February, \$1.50 to \$4.75; March, \$2.25 to \$5.75; April, \$3.62 to \$5.65; May, \$3.25 to \$5.50; June, \$2.12 to \$5.25; July, \$2 to \$5.50; August, \$1.25 to \$5.25; September, \$1.25 to \$4.90; October, \$1.50 to \$5.62; November, \$1.40 to \$4.75; December, \$1.55 to \$4,55.

Texas cattle.—The firm of Allen, Poole & Co. consists of five partners, and holds stock-lands of immense extent, of which the southern boundary extends from Galveston Bay to the extreme southwestern limit of Matagorda Bay. Allen's ranch, a comparatively small portion of this territory, touching Galveston Bay, is used as a pasture for stock

selected for shipment, and contains 12,000 acres. It cost $24,000, gold. It is well watered and sheltered by forests. Eight hundred mustangs are kept here for the use of the herdsmen and drovers. During 1873 the firm shipped from this ranch 20,000 beeves and calves for the Galveston market, 80,000 for New Orleans, and 20,000 for Cuba. Another ranch is eighty miles long and thirty miles wide, contains 1,200,000 acres of land, and feeds 120,000 cattle and 1,000 mustangs. The firm has an office in New York City for the sale of their canned beef, and recently a partnership has been formed between the firm and an English house in Liverpool for the sale of the article. At the time of writing Allen, Poole & Co. were closing a contract with the United States Navy to the amount of $90,000, and the military authorities of Prussia were negotiating for a yet larger supply.

Loss of cattle at the West.—A correspondent of the Department in Osage County, Kansas, writing in June, 1874, stated that, from the best information he could obtain, the loss of cattle in that county alone, during a very few months preceding, amounted in money equivalent to about $150,000, and that it was chiefly caused by a succession of storms since April 1, in connection with great scarcity of feed; many thousands of cattle throughout the State had died from these causes. Up to April the weather had been favorable.

FERTILIZERS.

Stable manure.—The following points are from a recent paper by Professor Goessman, of Massachusetts. Some of the material is the fruit of recent German experiments. At a temperature of 100° centigrade, the dry substance of the entire fresh solid and liquid excretions of cattle, sheep, and horses amounts, on an average, to 50 per cent. in weight of the dry substance of the food consumed. Professor Wolff thus states the percentage of the dry substance of the food of cattle found in the excrements:

	Cows.	Oxen.	Sheep.	Horses.	Average.
In the urine	9.1	5.8	6.6	3.6	....
In the fæces	38.0	45.4	46.9	42.0	....
Total	47.1	51.2	53.5	45.6	49.4

On an average, the weight of dry straw required for absorption reaches one-quarter of the weight of the dry substance consumed as food. Putting the composition of stable manure as 25 parts dry substance and 75 parts water in 100, it follows that for every 100 pounds of dry-food substance consumed 300 pounds of stable manure will be produced. Placing the daily amount of dry fodder consumed at 24 pounds for 1,000 pounds of live weight of the animal, and allowing 6 pounds of straw for bedding, the product of manure, in stable feeding, of an animal of the stated weight, will amount to 72 pounds daily, or 26,280 pounds per year. But considerable variation exists between the different classes of animals as regards the amount of straw required for bedding; the daily requirement of wheat straw being estimated at 6 pounds for a horse, 8 pounds for a cow, 4 pounds for a pig, and 0.6 pound for a sheep.

In general farming, if the farm-stock has been well fed, 1,000 pounds of the manure will contain 4.5 pounds to 5.8 pounds of nitrogen. The

commercial value of stable manure may be approximately represented by allowing for every ton of manure 10 pounds of potassa, 8 pounds of nitrogen, and 4 pounds of phosphoric acid. On account of the highly beneficial action of stable manure on the physical condition of the soil, its agricultural value, as a rule, stands higher than that of any commercial artificial fertilizer giving the same proportions of the named constituents. But a good concentrated fertilizer may, under certain circumstances, be a valuable assistant of stable manure.

It has been customary on large estates to calculate the nitrogen afforded by the excretions of the entire number of farm-animals at 75 per cent. of the nitrogen of the food consumed, allowing 25 per cent. for nitrogen carried off in milk, animal texture, &c. Taking cows and oxen, which require 6.5 ounces to 7 ounces of nitrogen in their daily food for each 1,000 pounds of live weight, their annual consumption of nitrogen per 1,000 pounds of live weight would range from 148 pounds to 171 pounds. A deduction of 25 per cent. being made, there would remain in the fresh excrement 111 pounds to 128 pounds of nitrogen; as much as would be found in 750 to 800 pounds of best Chincha Island guano, or in 3,200 pounds of bone-meal, or in 25,000 pounds of half-rotted barn-yard manure. But the efficiency of the excrements depends greatly on the preservation of the entire amount of liquids and solids. The following table, from Professor Wolff, shows the proportion in which the nitrogen of the food is distributed in the animal excretions. The figures exhibit the number of parts for 100 parts of nitrogen contained in the food:

	Cows.	Oxen.	Sheep.	Horses.	Average.
Nitrogen in solid excretions	45.5	51.0	43.7	56.1	49.1
Nitrogen in liquid excretions	18.3	38.0	51.8	27.3	33.9

But the excretions of high-fed oxen often contain 2½ times as much nitrogen and 3½ times as much phosphoric acid as those of cows or young cattle whose milk or growth carries off a large amount of the named elements.

Guano deposits of Peru.—The results of late measurements of guano-deposits upon several Peruvian islands are stated by the South Pacific Times, as follows: Chiapa, 89,000 cubic meters; Huanillos, 700,000; Punta de Lobos, 1,601,000; Pabellon de Pica, 5,000,000; Patache, 125,-000; Chavanoja, 150,000; Patillos, 16,000. As the cubic meter is represented to yield 2,866 pounds to 2,976 pounds of guano, these figures exhibit a total of more than 10,000,000 tons. In addition to this amount there is reported a very considerable aggregate from numerous islands of smaller size. Specimens of several of the deposits have been analyzed by order of the Royal Agricultural Society of England. Dr. Voelcker remarks, that those of Pabellon de Pica are very dry, of a clear brown color, and approximating the best guanos of the Chincha Islands. Those of Punta de Lobos contain a large quantity of sand, amounting, at 8 feet depth, to 28 per cent.; their average of nitrogen is small. The proportion of this ingredient varies at different depths, amounting to 6½ per cent. at 5 feet, and to 10 per cent. at 40 feet, where the guano is fine and still drier than that of Guanape, and contains as small a proportion of sand. The guano of Huanillos is very dry, pulverulent, and of clear brown color; the proportion of nitrogen varies from 7 to 10 per cent.; sand, from 2 to 6 per cent. Several specimens were rich in phosphate

of lime, but poor in nitrogen. Alkaline salts are present in large proportions. Dr. Voelcker says that, the variation in percentage of nitrogen being so great, the only just way of pricing cargoes from these deposits is by determining the value of each lot of guano according to chemical analysis. The English Royal Society has petitioned the government to urge the Peruvian authorities to regulate the prices of cargoes in accordance with some standard of analysis.

Fertilizers from refuse fish, &c.—In the statistics of the industry of Maine, for 1873, there are reported seven establishments in the State devoted to the manufacture of fertilizers from refuse fish, turning out annually 6,550 tons of fertilizers valued at an average of $12 per ton. There is also reported a factory in Lincoln County, manufacturing about 500 tons of seaweed fertilizer annually, averaging $30 per ton.

Waste of fertilizers.—A traveller in Webster County, Missouri, alluding to a statement in the State Agricultural Report, that the lands of the county had depreciated 25 per cent. since the war, gives some facts illustrative of the causes of the depreciation in fertility. He says that stopping at a farm-house while on a journey, he took his horses to the stable, but found it and the yard so filthy with the manurial accumulations of years that he led the animals back, preferring to expose them to the weather rather than to let them stand in the filth. Presently, in conversation with the farmer, the latter informed him that the seasons were every year becoming more unfavorable. The evident truth was that the man's land was yearly becoming poorer through bad management. The women of the household were busy in cleaning cotton by hand, carding, spinning, and weaving it, and earning scarcely 5 cents per day, while the men wasted the time of themselves and two teams which might have been profitably employed, in hauling out manure. The owner of a steam flouring and saw mill in Huntsville, Wright County, told him that he had tried to get his neighbors to haul off the mill-ashes, but no one would have them, and he would be obliged to throw them into the creek. The writer adds that one of his own neighbors complained that his land was becoming too poor to afford a living, and on the same day sold him between 40 and 50 loads of manure for a dollar. The writer is confident that in his own county there are wasted annually 100,000 loads of manure which, if properly applied, would return a yearly value of $200,000.

INDIAN CORN.

An extraordinary crop.—Mr. John W. Murray, of Carroll County, Maryland, reports in the Westminster Advocate that, in 1873, he raised on one acre 30½ barrels (152½ bushels) of shelled corn. He states that the land was so situated that it received the washings from the road and from his barn-yard, and had been in grass for fifteen years. In the spring of 1872 he plowed it and planted it in corn. The yield that year was 26½ barrels. On the 16th of May, 1873, he plowed the corn-stubble ground very deep, and harrowed and rolled it. The next day he sowed 300 pounds of bone-dust and harrowed it again, marked it off 32 inches one way, sowed 200 pounds of Rhodes's superphosphate in the rows, and dropped the corn, one and two kernels in the hills, 10 inches apart. The variety of corn was the Chester County Mammoth Yellow. On the 4th of June, much of the corn having failed to come up, he "dragged the ground and replanted;" plowed on the 10th, some hills still missing; on the 17th plowed, hoed, and "plastered the weak spots;" on the 30th dragged, plowed, and thinned; on the 4th of July "hilled with a

potato-plow as deep as one horse could pull," and continued to thin as it required until the shoots appeared.

Cost of growing corn.—A farmer at North Branch, New Jersey, gives a statement of the expenses and proceeds of his corn crop from 22 acres, in 1873, from which we deduce the following conclusions: Product per acre, 36.45 bushels, returning, at 70 cents per bushel, $25.51; value of corn-stalks, $4.55, making a total of $30.06 per acre. The expense account covers plowing, furrowing, dropping and covering, cultivating, hoeing, cutting, husking, and drawing corn to crib, drawing and stacking stalks, shelling, winnowing, bagging corn and taking it to market, wear of implements and tax on land, exhibiting an average expense of 39.65 cents per bushel, or $14.42 per acre, leaving a profit of $15.64 per acre.

Shrinkage of corn.—Mr. W. R. Shelmire, of Toughkenamon, Pennsylvania, reports two tests, going to show the shrinkage and loss of corn from harvest-time till about the first of the year, when new corn is considered equal to old. The exhibit includes loss by vermin. The variety of corn is not stated, but was the same in both cases. In 1871, however, the corn was not nearly as dry when taken from the field as was the crop of 1870 when harvested. The results of the two trials are as follows: Weight of ten measured bushels of ears, when cribbed, October 31, 1870, 401 pounds, showing an average weight per bushel of 40.1 pounds. The same corn, December 12, 1870, measured ten bushels, and averaged 35.5 pounds per bushel of ears. Loss of weight in forty-two days, 11.5 per cent. The corn was shelled at the last-mentioned date and exhibited the weight of the cobs at 19.7 per cent of the entire weight of ears. After fanning, the grain showed a loss of 1.24 per cent. in weight. Weight of one measured bushel of grain, before fanning, 51.3 pounds; of one measured bushel, after fanning, 52 pounds. In the second test ten bushels of ears weighed, when cribbed, November 10, 1871, 399.5 pounds, averaging 39.95 pounds per bushel. January 2, 1872, the same corn in ears measured ten bushels, and averaged in weight 34.45 pounds per bushel. Loss in weight of ears in fifty-three days, 13.8 per cent. On shelling at this date the grain weighed before fanning 260.25 pounds, showing the weight of the cobs at 24.4 per cent. of that of the entire ears. After fanning, the grain showed a loss of 2.9 per cent. in weight. A bushel of ears gave on an average 25.275 pounds of grain before fanning, and 24.525 pounds fanned.

The following is an abstract of a report of the superintendent of the Wisconsin University experimental farm on the loss of weight from drying and the amount of cob of four standing varieties of corn: October 11, 1873, 100 pounds each of Cherokee, early yellow dent, yellow dent, and white Australian corn, all in good condition, were husked and placed on a scaffold to dry. Eighty days afterward—December 30—they were weighed and shelled. The results are given below:

Varieties.	Yellow Dent.	Early yellow Dent.	Cherokee.	White Australian.
Weight of ears....pounds..	97.75	96.50	93.25	93.50
Loss of weight in drying....per cent.	2.25	3.50	6.75	6.50
Weight of shelled corn....pounds..	83.50	80.00	74.50	76.25
Weight of cobs....per cent.	14.58	17.09	20.11	18.45

The yield per acre of each of these varieties, weighed when drawn from the field, was, in pounds of ears, respectively, 3,702, 4,396, 3,958, 4,745. The yield per acre of shelled corn is given in the following table

	Loss of weight per acre in drying. Pounds of ears.	Pounds of cobs per acre.	Bushels of shelled corn per acre.
Yellow Dent	83	527	55.2
Early yellow Dent	154	726	62.2
Cherokee	267	741	52.6
White Australian	308	818	64.6

The corn having been stored in small quantities in a dry place, it is believed that it was as dry at the time of shelling as coru usually is when marketed at a much later period.

Shrinkage in one year.—A Pennsylvania farmer gives a report of the shrinkage of corn during one year, from November 19, 1872, to the corresponding date in 1873. When husked at the first-mentioned date, 200 ears measured 2½ heaped bushels, and weighed 120 pounds; the shelled corn weighed 98½ pounds, showing the weight of the cobs at about 18 per cent. that of the entire ears. Eighty ears heaped a bushel, and weighed 48½ pounds. At the close of the year 200 ears weighed 97 pounds, and the shelled corn 81½ pounds, showing the weight of the cobs at 16 per cent. that of the entire ears. Ninety-seven ears measured a heaped bushel, and weighed 46 pounds. Shrinkage of ears during one year, by measure, 17 per cent.; by weight, 19 per cent. Shrinkage of shelled corn in weight during one year, 17 per cent.

FRUIT.

Shipping cranberries to England.—Efforts have recently been made by the New Jersey Cranberry Growers' Association toward establishing a permanent business in shipping cranberries to England. It is hoped by this means to enlarge the general market for that article, and to check the downward tendency of prices consequent on the increase in cranberry-cultivation. In the latter part of 1874, Mr. P. T. Quinn, on behalf of the association, visited firms in London and Liverpool with a view to trade arrangements. He found that American cranberries were virtually an unknown article in the London market, but better known in Liverpool. A business-house in the latter city informed him that eight years ago five barrels of cranberries would have filled demands of that market, and that in 1873 over one hundred barrels of the fruit were sold there. He remarks that one great difficulty in the way of introducing the raw fruit into England is the entire want of knowledge there respecting proper methods of preparation for table use. Mr. Quinn concludes his report to the association by saying that it will require time, perseverance, and some outlay to fairly introduce American cranberries into England, but that, with well-directed efforts, a large demand for them can be created in that market. Other papers emanating from the association show that some small shipments made to England by that organization at the close of 1873 were unremunerative, and that the lateness of shipment contributed largely to the result. A London firm has been constituted the foreign agent of the association.

Peaches in the Delaware Peninsula.—At the annual meeting of the Delaware Fruit-Growers' Association, in the early part of 1874, the committee on peaches reported that in 1873 there were sent by rail from the Delaware Peninsula to Philadelphia and New York 1,288,500 baskets, or 2,577 car-loads, of peaches; and that, adding the quantities shipped by steamers and sailing-vessels, and amounts consumed in the home-canneries, the aggregate marketed would probably be about 2,000,000 baskets. The crop far exceeded the calculations made up to time of ripening.

Currants in Connecticut.—A correspondent of the American Agriculturist gives an account of the method of cultivating currants at Green's farms, Connecticut, where, as a specialty, currants are found to pay better than any other small fruit. The Versailles and Cherry varieties are relied on for the main crop. The plants are grown from cuttings, 6 inches long, planted at distances of four inches, in drills 16 inches apart, in rich soil. In the permanent plantation the young plants are set in rich soil, in rows 5 feet apart, at distances of 4 feet in the rows. They are kept clean by frequent cultivation throughout the season, and are allowed to throw out side-shoots, and to grow in the bush form. Some of the plantations are made in the pear orchard, and, where the ground is sufficiently rich, they bear abundantly in the shade. A small crop is obtained the third year. A full crop ranges from one ton to two tons per acre. A considerable portion of the profits of the currant-grounds is from sales of cuttings at $3 per thousand, and of plants at $30 per thousand. Three acres of currants on one of the farms produced 5½ tons of fruit, which sold for $1,375, averaging 12½ cents per pound. The currants are sent to New York and Boston.

Berries in New Jersey.—A correspondent in Burlington County, New Jersey, gives the report of J. S. Collins, of Moorestown, showing, for five acres of strawberries, in 1874, an average gross receipt of $350 per acre; for five acres of raspberries, $250 per acre. His blackberry crop was light; in 1872, his gross receipts for 75 acres of blackberries, in Camden County, were $22,500, averaging $300 per acre. The Park Cranberry Association, having a large plantation in New Hanover Township, received from commission merchants, in 1872, $34,732.70, after deducting charges for freight, city cartage, and commissions. The crops of 1873 amounted to over 10,000 bushels, but, owing to unusually low prices, the value realized was much smaller than in 1872.

Old apple-trees.—The secretary of the Maine board of agriculture, in his late report, mentions an apple-tree at York, in that State, that was brought from England, over two hundred years ago, in a tub, and that was still bearing fruit in 1870; another, near Wiscasset Bay, that was an old tree in 1805, but is still fruitful; and another, in the town of Bristol, known to be over two hundred years old, and still bearing fruit.

Cranberry-production.—Mr. N. R. French, statistician of the New Jersey Cranberry-Growers' Association, estimates the cranberry-crops, and their sources, for the past three years, as follows:

	1872.	1873.	1874.
	Bushels.	*Bushels.*	*Bushels.*
Cape Cod and adjacent islands	20,000	80,000	35,000
Massachusetts (remainder of) and Rhode Island	20,000	25,000	70,000
New Jersey	100,000	110,000	90,000
Wisconsin, Minnesota, Indiana, and Michigan	135,000	60,000	50,000
New York	....	....	5,000
Total	275,000	275,000	250,000

The area under regular cultivation in New Jersey, in 1874, is estimated at 4,969 acres, and the capital invested at $1,662,130. Though there was an increase in acreage over the previous year, the crop was 25 per cent. less. The rot, with the failure of the crop on new bogs, is the assigned cause.

Shipments of persimmons.—Twenty cases of persimmons, packed in drawers, were recently shipped to Chicago from Edwardsville, Ind. The fruit had been carefully cultivated and was of fine quality.

Fumigating plum-trees.—A Michigan fruit-grower states that the experience of five seasons has proved to him that fumigating with coal-tar is a preventive of the ravages of the curculio on plum-trees. His practice has been to fumigate strongly as soon as the blossoms open, working very early in the morning, while the dew is on. The treatment was continued on alternate mornings till the fruit reached the size of a small hickory-nut.

POTATOES.

Special cultivation of potatoes.—At a meeting of the London Society of Arts, Mr. Shirley Hibberd read a paper, in which he suggested the geothermal culture of potatoes, especially for raising new varieties for seed. He proposed that tiles be laid in lines four feet apart, and a little soil placed upon them, in which the potato-sets are to be put. As a substitute, designed for a comparatively inexpensive garden culture, planting above heaps of slates, common stones, &c., was recommended. The principle is that of raising the potato above the common level of the soil, and inclosing a body of air beneath their roots, thus securing an accumulation of earth-heat. A perfected system of tiles, carrying out his plan in full, would cost £66 per acre.

Potato-culture.—F. M. Hexamer, of Westchester County, New York, well known as a grower of potatoes, states his method of managing the crop. The following are the leading points of his statement: He usually plants potatoes in land which had been heavily manured for corn in the previous year with stable-manure; applies no manure with the potatoes. Plows eight or ten inches deep, harrowing smoothly, and picking off the larger stones from the surface. He uses a planter for putting in the seed, and has found by trial that a planter, with a horse. a man, and a boy, would do more work than ten men, with two horses and furrowing-plows. As soon as the sprouts are above ground he runs a Thomas smoothing-harrow over the field in the direction of the drills, repeating the harrowing at intervals of eight or ten days, or whenever weeds appear, until the vines are about 6 inches high. It is very rare that any hill is actually injured. The plants, though laid flat in this process of weeding, spring up next morning as fresh as ever. The harrow is used most favorably on a bright, sunny day, just after a rain, when the soil mellows easily. A few days after the last harrowing he begins hilling with a double mold-board plow, using at first only the stationary mold-board, without the center-piece. The hilling is repeated at intervals of a week, each time with an additional flange to the mold-boards, using the center-piece the last time. Cultivation is stopped when the blossoms appear, but care is taken to pull by hand the few weeds that occasionally appear.

TREES AND TIMBER.

Clearing forests by steam-power.—Experiments were lately made in Scotland, under the direction of the Canadian Land-Reclamation Company, for the purpose of testing a process patented by Mr. Andrew Gilchrist. A traction-engine of twelve horse-power being stationed near a wood, a wire chain is fastened to the tree which is to be removed, and then the steam is raised, and the tree pulled out by the roots. The plantation experimented on was nearly one hundred years old, and in five hours more than three hundred trees were pulled out. Of this number not more than six were broken, and this breakage was attributed wholly to the inexperience of the laborers employed, and their placing the chain too high on the trees.

The Eucalyptus in California.—According to estimates made in the early part of 1874, at least 1,000,000 trees of *Eucalyptus globulus* have been planted in California, in streets of principal cities and in country localities where the winter is sufficiently mild.

Preservation of wood.—In 1830 there were dug up at Rouen, France, some oaken piles which had been buried six hundred and eighty years; they were found as black as ebony, and extremely hard. M. Hatzfeld, a manufacturer of Nancy, who took great interest in the subject of the preservation of timber, claimed that this condition was caused by the large quantity of tannic and gallic acids contained in the oak, and combining to harden its fibers. Chemistry had long before referred the dark color to a union of the gallic acid of the wood with iron, which is found to greater or less extent in all soil. M. Hatzfeld proposed to impregnate the wood for preservation with tannin and then with acetate of iron. The process is stated to be cheap, and the acid does not injure the fiber of the wood. A telegraphic company has been testing the process on a large scale on a French railway-line, the poles being prepared at Nancy, by M. Hatzfeld. The Journal of Applied Chemistry, stating these facts, remarks that considerable disadvantages have been experienced in carrying on most of the hitherto offered processes of preservation. Impregnating with poisonous substances, such as chloride of zinc and sulphate of copper, as a special protection against animal and vegetable parasites, is open to the objection that rain and moisture of air and soil dissolve them after a time. As to patents for impregnating with insoluble materials precipitated in the wood by the successive action of two soluble substances, employing for instance phosphate of iron, sulphate of baryta, and silicate of iron, it is found that the acids freed by the mutual decomposition and precipitation attack and injure the fibers of the wood. The more recent saturation with creosote prevents decay, though it does not harden the wood. But the apparatus employed is costly, and the process requires much time, and is difficult and expensive.

POULTRY AND EGGS.

Poultry in Iowa.—A firm of poultry-dealers in Iowa stated to the Iowa Farmers' Journal, in the early part of 1874, that their operations in one week covered 37,000 pounds of poultry—turkeys, chickens, geese, ducks, &c. They were employing more than thirty men in the dressing and cleaning rooms, and were disbursing about $3,000 weekly. They ship to New York and Boston.

Receipts of eggs in New York.—The Poultry Bulletin states the receipts of eggs in 1873, by commission and wholesale dealers in New York City, at 31,148,070 dozen, valued at $6,976,603.35, against 28,360,410 dozen,

in 1872, valued at $6,292,250.57; average value per dozen in 1873, 22⅜ cents; in 1872, 22½ cents. In calculating total receipts, about 20 per cent. should be added to the above-named quantities for receipts by marketmen and small dealers.

The egg trade.—A report of a committee of the New York Butter and Cheese Exchange, in June, 1874, says that eggs are shipped to the New York market from the second tier of States west of the Mississippi, from Canada, from Georgia, and Tennessee, and from all intermediate States. During the spring months skillful packers are able to place their eggs in New York from beyond the Mississippi in such good condition that they reach nearly the price of eggs packed equally well at about two hundred miles distant from the market. But in warm weather there is great loss in eggs shipped from extreme distances. The committee recommend the appointment of egg-inspectors who shall examine receipts and grade them into different classes according to condition, branding the packages with the name of the State from whence shipped, grade, date of inspection, &c.

The American Grocer says that eggs reach the New York market chiefly in barrels, containing from seventy to seventy-five dozen, packed in straw, seldom in bran. The best material for packing is rye-straw, cut in lengths of half an inch. Oat-straw is quite objectionable, being too heating. Farmers or dealers desiring to hold their eggs, pickle them in lime-water, to keep over the hot season. These limed eggs are easily distinguished by experts. They serve for frying, and for cake, and are largely used by bakers. They bring three to five cents less per dozen than other eggs.

Poultry on the farm.—The Delaware County American (Pennsylvania) says that a farmer's daughter in Concord Township in that county commenced in the spring of 1873 with sixty hens, common breeds, and two Cochin cocks, and from these raised three hundred and fifty chickens. During the season she sold eggs to the value of $90, and from September 20 to January 17 she fattened and sold one hundred and fifty pairs of fowls for $260, making the total of sales $350. About two hours daily were occupied in caring for the hens.

MISCELLANEOUS.

Prussian Agricultural Museum.—The Royal Agricultural Museum of Prussia, at Berlin, was opened April 4, 1868, in temporary quarters. It possesses a large collection of seeds, grains, fruits, and samples of miscellaneous agricultural products, and is provided with a library, and with models of machines, or actual machines, and illustrations of the different tools and processes employed in agriculture. The collections occupy two stories of an irregular building, and are a ranged in seventeen apartments. The first apartment contains specimens of wood, native and foreign, including fine collections from Canada and Australia. Three rooms are devoted to wools and woolen fabrics, including yarns and cloth in all stages of its manufacture. In the machine halls are to be found drilling-machines, mowers, and harvesters of all dates of invention; flax-machinery from various countries is also exhibited, food-steamers, &c. The different systems for improvement of swamps, reclamation of meadows, irrigation, and utilization of sewage, are illustrated by appropriate models. Hall 7 is filled with plows, home-made and of foreign manufacture. In three glass cases are contained 187 models, illustrating the history of the plow from the earliest dates to the present time. There are also eight cases of hand tools of all

nations. Corridor 8 contains models of dairy apparatus. Elsewhere are found implements for wine-making, exhibits of various processes of starch-making, models of barns and farm-houses, horseshoes, and exhibits of methods of shoeing, bees and bee-hives, cases of sugar, with illustrations of its manufacture; flax in different stages of preparation; painting of cryptogamic plants; models of all parts of flowers of cultivated plants. The plan of the institution includes lectures illustrated by the collections. These lectures the students of the agricultural college are expected to attend. During three days in each week free admission is given to the public, and special permission for study may be obtained by students on application. At the close of the first year the museum contained 17,000 specimens, and in the early part of 1874 the number had reached 27,000. Most of the specimens were donations.

Conditions of adaptation.—M. Naudin illustrates the losses of time and money which arise from inattention to the meteorology of acclimation by the attempt made many years ago to introduce tea-culture into France. The experiment, made at a large expense, failed for the reason that the temperature and the degree of atmospheric moisture necessary for the profitable culture of the plant did not exist in that country. The costly trial was undertaken without a proper preliminary investigation. The success which has attended the recent enterprise of the English government in the cultivation of the cinchona in India, was the consequence of a careful study of the conditions, climatic, &c., of the South American habitat of the tree, and a selection of localities in which those conditions could be sufficiently approximated.

Crops of Great Britain.—The agricultural returns of the island of Great Britain show the following acreages of principal crops and amounts of live stock during the named years:

Crops.	1867.	1871.	1872.	1873.
Wheat ....acres..	3,367,876	3,571,894	3,598,957	3,490,380
Barley ....do...	2,259,164	2,385,783	2,316,332	2,335,913
Oats ....do...	2,750,487	2,715,707	2,705,837	2,676,227
Potatoes ....do...	492,217	627,691	564,068	514,682
Turnips, Swedes and Mangolds ....do...	2,431,976	2,524,261	2,412,697	2,447,616
Hops ....do...	64,284	60,030	61,927	63,278
Cattle ....number..	4,993,034	5,337,759	5,624,994	5,964,549
Sheep ....do....	28,919,101	27,119,569	27,921,507	29,427,635
Pigs ....do....	2,966,979	2,499,602	2,771,749	2,500,259

The enumeration of pigs does not include those kept in towns and by cottagers. The estimated population of the island, in 1867, was 24,852,540; according to returns of 1873, the population was then 26,787,337. This tabular exhibit illustrates the stability of British agriculture and the small variation in the acreages of leading crops from year to year. At the same time it shows the current tendency to a gradual diminution of the grain-crops and to increase in meat-growing.

Cinchona plantations in India.—At the commencement of 1874, the London Medical Review stated that the total cost of introducing the cinchona into India had amounted to £70,000, and that the annual sales were giving a net profit of £4,000 to £5,000 yearly. At a recent sale in London of cinchona-bark from the Nilghiri plantations, 23,646 pounds of bark were sold for £3,350, showing an average of 2*s.* 10*d.* per pound. One lot averaged 5*s.* 9*d.* per pound.

History of a farmers' club.—The Elmira (New York) Farmers' Club originated, about the commencement of 1870, in the meeting of ten

farmers at evening in a wagon-shop, by the light of a single candle. These persons organized a club for improvement in farming. Reporters from the city press were invited to be present at the meetings, which thus gained notoriety. The club now numbers more than one hundred members, and has a large hall in a central situation in Elmira. The first floor of the building is occupied by the janitor's family, and the rent of these rooms provides for warming and lighting the hall and maintaining it in proper condition. The club possesses a library of 1,200 volumes, commenced in 1871. Every year the organization has carried out some beneficial enterprise. In 1870 a grand trial of haying implements was had; in 1871, a trial of all kinds of implements used in working the soil. These trials were attended by crowds of farmers from distant parts of the country. In 1873 there was a trial of haying and harvesting tools.

A mechanic's experience in farming.—It is reported that in 1857 Mr. Arthur Dungan, a machinist by trade, wholly unacquainted with with farming, came to Palermo, New York, and bought sixty acres of sandy, exhausted land, inclining in some places to gravel. He paid $1,800, and had $200 left. He began by buying and applying ashes and plaster, and growing potatoes, which he carted fourteen miles to Oswego, bringing back manure from the livery-stables. His crops in- reased, and he continued to dress heavily with ashes, notwithstanding the unfavorable comments of old farmers in the neighborhood. He now buys about 2,000 bushels of ashes annually, and raises chiefly potatoes and wheat. The former have for some years averaged 250 bushels per acre, and his winter-wheat has averaged thirty bushels per acre. In 1869 he sold potatoes and wheat to the amount of more than $2,300. From the profits of his farm he has now $12,000 invested in bank-stock. He is reported to be the richest farmer in the county, and holds his farm at more than $100 per acre.

Prices of skilled labor near London.—The Labor News (English) states that there are hundreds of skilled laborers working in market-gardens, horticultural gardens, and the great floricultural hot-houses around and in London, whose wages average 12*s.* *to* 18*s.* per week, with no perquisites, while they work harder than thrashers, plowmen, mowers, and other tillers of fields. Among the employés in London nurseries and exotic establishments, there are many skilled gardeners working for 12*s.* per week, who are Latin scholars, botanists, landscape surveyors, and chemists.

The West Albany hay-market.—The Turf claims that West Albany, N. Y., is the largest hay-market in the United States. According to an estimate made by Mr. John Slingerland, of West Albany, the quantity of hay in store at that place in the early part of 1874 amounted to about 150,000 tons, occupying acres of barns and other storage-rooms.

Dull knives in mowing-machines.—Mr. F. D. Curtis calls attention to the fact that at a recent trial of mowing-machines at Poughkeepsie, N. Y., a careful dynamometer test showed that the draught of the machine was increased nearly one-third when the knives were dull. The knives thus tested were only moderately dull, having been used to mow one acre only.

Alfalfa in California.—A farmer residing in the lower King's River country, California, not far from Tulare Lake, states that in 1873 he cut from five acres of alfalfa twenty tons of hay, which netted him $10 per ton, and raised 2,200 pounds of seed, which netted 20 cents per pound. Total net proceeds from five acres, $640.

Woolen mills on the Pacific coast.—The following is reported for the six woolen factories in California and the three in Oregon: Amount of wool used in 1873, 5,380,000 pounds, valued at $1,200,000; value of manufactures, $3,000,000. Three million six hundred and eighty thousand pounds of California wool were used, 1,200,000 pounds of Oregon wool, and 500,000 pounds of Australian; 250,000 pounds of cotton were also used.

Oregon flour mills and cloth factories.—Pacific coast papers state that in 1873 the Salem, Oregon, flouring-mills turned out 33,800,000 pounds of ground stuff, viz, flour, 26,000,000 pounds; bran, 6,500,000 pounds; shorts, 1,300,000 pounds. During the same year the Willamette Woolen Mills turned out 299,000 yards of cloth, using 400,000 pounds of wool.

Chiccory in California.—A chiccory factory was established in 1872, twelve miles east of Sacramento City, California. The farm consisted of 180 acres, of which 70 acres were rich bottom-land. Sixty acres of this were seeded to chiccory in January and February, 1872, and were cropped in July, August, September, and October. The land was prepared by deep plowing, replowing 6 or 7 inches deep just before planting, thoroughly pulverizing with a harrow. The seed was put in by a drilling-machine, in drills about one foot apart. As soon as the shoots appeared above ground, twenty-five to thirty Chinamen were employed in weeding and hoeing, working about ten weeks, till the weeds cease growing. In harvesting, four Chinamen, with sharp hoes, cut off the tops, which were turned under by an eight-horse plow, while the roots were turned to the surface. Laborers following the plow threw the uncovered roots in piles, and others, coming after with a kind of potato-hook, disinterred whatever plants were not unearthed by the plow. The roots were then loaded and carried to the factory, where they were passed through a shoot in order to remove sand, &c. From thence the roots were passed to the cutter, a knife-armed cylinder, which, revolving rapidly, cut them in strips 2 or 3 inches long by one-quarter inch or more in thickness and width. These were raised to a large drying-platform, where they were spread in a layer about 2 inches thick, and stirred daily for a week, at the end of which period they were sufficiently cured for roasting and storing.

The roasting was done in the second story of the factory, which was three stories high. The roaster was a sheet-iron cylinder, 4½ feet long by 2 feet in diameter, supported by shafts, and revolving in a brick oven. Five bushels constituted a charge for the roaster, and two hours were required for roasting. When this was completed, the chiccory was poured out, cooled, and passed to the first floor, where it was ground in a mill. The chiccory was then sieved, the coarser portions reground, and the rest passed through a fine sieve before barreling. The factory turned out five tons of chiccory per week, running in the day-time only. It employed a ten horse-power engine for motive-power. Prices in 1872 were low and profits small.

A productive onion-plot.—Mr. William Miller, of Combe Abbey, England, says that, in 1873, he weighed the product of one-fifteenth of an acre planted in Banbury onions, and found the weight to be 3,960 pounds. This is nearly equivalent to two tons of 2,000 pounds. Mr. Miller gives the following history of this piece of ground: Some years ago, for a special purpose, the whole of the surface-soil, or garden-loam, was carted away, leaving only a stiff clay subsoil. The bed of clay was roughly dug over and exposed to disintegration through summer and winter weather. Plenty of farm-yard manure, obtained from his

own yards, was mixed with the earth, and the plot also received a dressing or two of disused pottery-earth of a sandy composition, in lieu of pit-sand, which would have been preferred. The soil was turned over after every crop, going deeper every time, though never bringing the bottom earth directly to the top. By this course a cultivable bed over two feet deep had been formed, and the purpose was to proceed till it should be made three feet deep. Mr. Miller appears to have grown the above-mentioned crop from the seed; the rows were not thinned out.

Variations of plants.—Thomas Meehan, the well-known horticulturist, adduces facts, within his experience, in support of the proposition that changes in the forms of organs of individual plants are not always by gradual modifications, but that they are often sudden, and of such decided character as to seem generic. These sudden formations perpetuate themselves in like manner as forms arising from gradual modifications. The variations result from causes affecting nutrition, and perhaps from other causes.

Camphor a stimulant of germination.—Experiments with camphor have shown that it stimulates the germination of seed, causing more seeds to sprout, and hastening the time of germination. Turpentine appears to have a similar action, but injures the further development of the plant, which camphor does not.

Correspondence of tides with the flow of sap.—The following is the substance of a dispatch from the United States consul at Cadiz, Spain, communicated to this Department by the Secretary of State. It touches the theory of a common influence governing the ebb and flow of tides and the flow of the sap of plants. A Madrid paper of respectable standing has published an article signed by Don Luis Alvarez Alvistur, on the influence of the tides on vegetation, in which the writer announces a theory, based on the results obtained during fourteen years devoted to experimental research, by an enlightened landed proprietor of Lorca, in the province of Murcia.

The theory adopted was the direct influence of the tide on the circulation of the sap; and its experimental application, after determining the meridian of the estate and tabulating the corresponding hours of ebb and flow, has been the felling and lopping of forest trees solely during the hours pertaining to the ebbing tide. The results are stated to have been conclusive, the decay annually observable formerly in some portion of the timber having ceased completely in the many years that have elapsed during the application of the new principle. The system was then applied to an olive-grove, the yield of which had ceased to cover the annual costs of culture, by removing every dried portion of the trees exclusively during ebb tide. The result is stated to have been the complete transformation of the grove, a great development of foliage, and abundant crops.

Equally admirable results ensued from the similar treatment of orange, lime, and other fruit trees, which were thenceforth unaffected by larvæ or other plagues which smote adjoining orchards; and, finally, the vineyard of the Lorca landlord, though surrounded by those of other proprietors, which were devastated by the oidium, which appeared in the district at the period when the new system was first essayed, have never exhibited the faintest trace of the malady.

Fighting the chinch-bug.—A farmer in Allen County, Kansas, says that the chinch-bugs have been very destructive in that region during the current season, marching in herds, and sweeping away entire fields of wheat and corn as they go. He adds that the following course has been found an effective means against them when perseveringly pursued:

A ditch as deep as the plow will run is made along that side of the field on which the insects are entering; then a horse is hitched to a log four to six feet long and ten inches or more in diameter, and kept walking back and forth in the ditch. The bugs, coming in, gather at the bottom of the ditch, are prevented from climbing up the other side by the finely-pulverized earth until the log, returning, crushes them. A neighbor, alarmed by their multitude, took two lengths of stove-pipe, put an elbow on one end, and filled the pipe with kindling material, to which he set fire, and drew the pipe through the ditch with the elbow turned toward the field, so that the issuing flame destroyed whatever bugs were attempting to escape up the inner declivity of the furrow.

Geese in the cotton-field.—As a labor-saving expedient Mr. Olmstead, residing on Bayou Meto, fifteen miles from Little Rock, keeps about one hundred geese for the purpose of destroying the grass in his cotton-field. "They keep his field as clean as newly-plowed ground, never touch the cotton-plant, and, besides, pay for themselves in feathers."

Fish in first and second hands.—Boston papers of May, 1874, contained accounts of the disagreement between the market fish-boats and the wholesale fish-dealers of that city. The former claimed the right to sell at retail after supplying the calls of wholesale dealers. The latter, resisting the claim, associated themselves together, and bound themselves not to purchase of any vessel which sold at retail. The boats got only 1½ cents per pound out of the 10 cents per pound paid by consumers.

Canning-factories in Maine.—In 1873 there were in Maine thirty-three canning-factories, employing a capital of $825,000. The official statement of their products for the year shows 475,000 dozen cans of corn, 7,500 dozen cans of succotash and shell-beans, 231,600 dozen cans of lobsters, 20,600 dozen cans of salmon, and 1,600 dozen cans of clams; total value of products, $1,842,000. In these factories were employed 2,027 men, 1,760 women, and 300 children, and their wages amounted to $262,500. The business is chiefly controlled by three Portland packing companies, and these firms also put up a large amount of meats in the winter season.

The corn-canning factory of Burnham & Morrill, at South Paris, Me., had, in 1874, 240 acres planted in sweet corn and 24 acres in beans. They used about 300,000 cans for the fall season.

Pickles and canned corn.—The canning establishment of Mr. William Archdeacon, at Crystal Lake, 43 miles from Chicago, Illinois, occupies 13 acres of land, about half of which are covered by the buildings. Of three one-story erections, 260 feet by 45 feet, two are chiefly devoted to the handling and pickling of cucumbers, with a capacity of 70,000 bushels. The other is devoted to packing. Other large buildings, some of them over two stories high, are used for canning green corn and other produce, the manufacture of white-wine vinegar, of which immense quantities are used on the premises, cooper-work, and box-making. A large number of persons are employed in the establishment, 1,000 being required for pickling cucumbers alone during their season. Steam is employed for power and for heating the buildings, and gas, for lighting them, is manufactured on the spot. Two rail-tracks are laid through the grounds. One thousand car-loads are received and delivered annually by the Chicago and Northwestern Railroad. The products worked up by the factory are chiefly obtained by it through contracts made in the spring with neighboring farmers. The number of contractors during the recent season was 350; number of acres covered by the contracts, 1,726; of which 943 were in cucumbers, 269 in tomatoes, 103 in green pease, 78 in green beans, 60 in cabbages, 16 in cauli-

flowers, 12 in small onions, and 8 in horse-radish. The location of the factory at Crystal Lake has resulted in a large advance in the market-value of surrounding lands. Mr. Archdeacon has organized a horticultural society among the patrons of the factory, and has fitted up a hall and provided a library for the use of the society.

Protection against birds.—A correspondent of the London Field says that he has found a convenient expedient for preventing birds from ravaging small fruit and garden produce. He takes a fine, dark-colored linen thread, and secures one end of it to a twig of the bush, and then stretches it to other twigs, backward and forward. The birds, flying down on the fruit, strike against these almost invisible snares, and are frightened by the apparent mystery. With pease and other seeds sown in drills, he stretches one or two lines of thread along each drill, at the height of two inches above the ground. This is found better than a greater height from the ground, where the birds would more readily perceive the character of the contrivance.

A Colorado potato-field.—It is reported that the potato-field of Mr. Rufus Clark, near Denver, is 150 acres in extent, and that its yield for 1874 is estimated at 25,000 to 30,000 bushels. During the season more than $2,000 were expended in defense against the potato-beetle.

Visitors at the Kew Gardens.—The Royal Gardens, Kew, England, are open to the public on every day in the week, after 1 o'clock p. m. The number of visitors in 1873 was 683,870. On June 2 there were over 59,000 visitors.

MODERN FARMING IN AMERICA.

By Augustin L. Taveau.

Progress is the watch-word which seems, by common consent, to have been adopted by the present generation—progress in art, science, commerce, and manufacture. And agriculture, under the same inspiration, has made giant-strides toward obtaining her niche in the grand temple of science. What has been accomplished by chemistry through the noble discoveries of Liebig, Boussingault, Johnston, and others has been ably seconded by the great creative genius of the inventors of labor-saving machinery; and the names of Hussey, McCormick, Wood, Whiteley, and a host of others should ever be treasured in the memory of the progressive farmer as his great benefactors.

The farmer of to-day is not the dull plodder of the past; if he would occupy the front rank, he is called upon to use his brains as well as his hands. And he who now sows according to the changes of the moon, or sows, tills, and reaps with awkward old-fashioned tools, will be outstripped in the race with the farmer of progress; who, while working with his brains, throws the burden of muscular labor upon the powerful sinews of his team or steam.

Human nature, perhaps, is the same now as it was six thousand years ago; and the man of progress to-day still has to encounter, and ignore, the jeers of his more obtuse neighbors. We infer from Holy Writ that the venerable Noah, even, in the building of the Ark, was regarded as wild and cranky in his formidable preparations for that flood which was to deluge the world; and had he possessed less of

that "grit," which perseveres in spite of all obstacles, who of us would be here to-day to tell the tale? Where would be the magnificent net-work of iron-bound roads, thundered over every second of the twenty-four hours by the great steam-horse, harnessed to a chariot of which Apollo might have been proud, coursing along at the rate of a mile a minute, with a comet-like train of precious freight, had not the indomitable grit of George Stephenson triumphed over blind prejudice? Who would have witnessed the magnificent spectacle of the great ocean steam-fleet, whose smoke curls over the waters of every sea on the globe, had the great pioneers of that enterprise listened to the learned prejudices fulminated against its attempt? Would the earth to-day have been "girdled in forty minutes" had Morse succumbed to the idle jeers and sneers of the ignorant? And it is to all such men that the world owes its greatest debt of gratitude; but it is a reflection on human nature that all such men are, generally, either looked upon with suspicion, or regarded a "little cracked." But the time is at hand when, with our boasted intelligence, this must cease. We must learn to educate ourselves up to that standard of progress which is the inspiring theme of all such natures. We no longer live in an age in which the "fool and his bells" is the greatest delight of courts.

And, as it is with these departments, so is it also with agriculture The farmer of to-day must have nothing of the clown or clod-hopper tacked to his skirts. He must be a *live* man, bold in experiment, frank in conviction, and as free from prejudice as he would wish to be of the plague. In this spirit, let him attend the great agricultural fairs; and, in that magnificent display of modern farm-implements, recognize the triumphs of genius which offers to aid him in overcoming the toil of manual labor. But, to utilize these to the greatest advantage, he must be willing to educate himself to their use. All machinery is more or less complex, but not, on that account, necessarily requiring the skill of a trained engineer. The most complicated machinery, in the hands of an intelligent man, anxious and willing to learn how to handle it, will give more satisfaction than one of simple construction in the hands of a person who is a bundle of prejudices. Observation, patience, and a little common prudence will be rewarded with perfect success; while the want of these will result in failure—and failure prompts its victim, too rashly, to condemn what is in itself really a blessing.

In view of the great scarcity and cost of manual labor in our country, we propose to review what has been done for the farmer in the way of substituting machinery for human muscle, as well by steam as by animal power; and, in doing so, we will say what we know from actual, and mostly personal, experience in the matter; and will make it our aim to endeavor to convince the farmers at large, but more particularly those of the South and West, that the period has come when they must, of necessity, rely with confidence upon machinery to develop to their highest capacity the broad acres of their generous soil. And first upon the list we must deliberately place

THE STEAM-PLOW.

Who can overestimate the great part this powerful implement is destined, beyond all doubt, to take in rendering this country the granary of the world, and in developing our resources in a hundred other ways as yet scarcely dreamed of? If, so far, this implement of the first importance has not made that great advance which it will be found by experience it is justly entitled to, it has been because the farmer him-

self has clogged its wheels with incredulity and prejudice. Those who have endeavored, and are still endeavoring, to place this untiring and powerful steed in the grand fields of this country, have not met with that encouragement from the planters and farmers which a matter of such grave importance ought to receive.

If good drainage and thorough pulverization of the soil are the foundations of the highest form of agriculture, the experience of such men as Lawrence of Louisiana, and Hampton of Mississippi, and a host of the best farmers of Great Britain, together with that of the Pacha of Egypt, all attest, in the most unqualified language, this most important truth. An implement which, at less cost than that of animal-power, penetrates the soil to a depth of 20 inches, thoroughly breaking up the hard-pan underlying it, and permitting not only the heavy rains to percolate beneath, but also during some drought allows the moisture from below to rise and stimulate a vigorous growth, which otherwise, under the scorching rays of the sun, becomes stunted and withered—such an implement, beyond all question, must, in the nature of things, become a necessity to every one desirous not only of gain, but of being considered a man of progressive ideas. Nor must we overlook the important circumstance that here there is no incessant packing of the soil by the tread of animals, but, once cultivated, the land is left in that high state of tilth recognized as "spade-husbandry." The experience of those using these implements tells us also that one such plowing is from its thoroughness capable of taking the land through a series of seasons equaling a proper rotation.

In point of economy, also, animal-power can bear no comparison with steam. It is usually estimated that to break up an acre of sward 10 inches deep, with horses, costs not less than from $2.50 to $3. We find, from the most recent accounts of farmers in England, that, with their powerful engines of thirty-horse power, they are able to break up their land to a depth of 18 or 20 inches, at a cost as low as from 50 cents to 75 cents per acre. If the comparison ended here only the enormous gain in this one point alone would be sufficient to satisfy the most skeptical; but, upon going further and looking into results, we learn that the yield of crops is actually augmented from one-fourth to one-third. And, to come nearer home, the increase of yield in sugar in Louisiana is 50 per cent. greater than by horse-power.

Many of our farmers are under the impression that the great first cost of a steam-plow renders the venture of doubtful advantage. In this there is also error, although it is true that some of the plows imported from England have been obtained at high figures; but engines from abroad have recently been introduced into this country at a cost of $5,000, and there is every reason to believe that, if our own inventors were encouraged by the farmers, American mechanics could turn out a good implement at even less cost. In comparing the two systems, we find the following result:

Cost per diem by steam.

Three men and one boy	$4 00
1,000 pounds coal, at $6 per ton	3 00
Water-cart	2 00
Oil, &c	1 50
Wear and tear, at 10 per cent	1 25
Interest on $5,000, at 6 per cent., less Sundays	1 00
Cost of fifteen acres	12 75
Cost per acre	85

Cost per diem by horses.

Breaking up 15 acres, at $2.50 per acre	$37 50
Interest on value of horses and tools	50
Wear and tear of horses, harness, and tools	1 00
Cost of 15 acres	39 00
Cost per acre	2 60
Cost per acre by steam	85
By credit in favor of steam per acre	1 75

After allowing for reasonable differences in the above estimate, what really progressive farmer can longer remain in doubt upon the subject? These figures, also, apply to machinery imported from abroad. What if a more economical engine were got up at home? And just here lies the whole matter in a nut-shell—the lack of a home demand.

Upon one occasion application was made to one of the largest engine-builders in the country upon the feasibility of getting up steamers in our own country. He replied: "It has taken fifteen years, and millions of capital, to educate the farmers to the point of using steam for any purpose; and there is not one neighborhood in a thousand where they believe in it yet. There are greater difficulties in the way than want of practicable machines for steam cultivation." If this be so, it is a stigma upon their name, which they should lose no time in wiping out. Our inventors are doubtless capable of meeting the issue, whenever the call is made; but in this, like every other commodity, there is no supply where there is no demand. We say, then, to the progressive farmers, that it is to you alone the country must look to wipe out this reproach to American agriculture. And, in taking the matter into consideration, it must be borne in mind that these are not merely implements for plowing alone, but that they are constructed to do all the farm threshing, grinding, sawing, hauling heavily laden wagons, and even repairing and consolidating the roads by rolling. So that, by judicious management, there need be no want of occupation for the engine any more than for the horses of the farm. And as regards the skill necessary for their management, we find that in Louisiana the ordinary hands are in a short time quite capable of taking charge; and, indeed, in England, the experience is that the best farm-hands are more skillful in their management than "men from the shops." To the planters of the South, who are working under the great cloud of a sparse and disorganized labor, we say, here is the grand solution of your problem. Wait not for the advent of the immigrant and "heathen Chinee," worshipping false gods, but, with the Christian labor around you, harness the mighty power of steam to the car of Ceres and command success.

THE STEAM-DITCHER.

Under the title of marsh and swamp lands, hundreds of thousands of acres of the richest and most valuable soils are to-day nothing more than howling wildernesses, on most occasions a curse to the neighborhood wherein they might, by drainage and cultivation, be turned into real blessings, and fever and pestilence routed from their stronghold. To aid us in the attainment of so desirable an end, we ought gladly to welcome the steam-ditcher.

In Colusa County, California, the Tule Land Reclamation Company gives employment to four or five hundred men. The company owns forty-two thousand acres of overflowed swamp-land; and, with the aid

of a powerful steam-ditcher, it is estimated by the company that it costs but $2 an acre to reclaim it. How almost incredible does this seem when compared with the reclamation of swamps by manual labor! Before the war, it was estimated by the rice-planters of the South, with abundance of slave-labor at command, that it cost about $150 an acre to reclaim cypress lands, and about $100 an acre to reclaim marsh lands.

The work done by this machine is, also, of the most thorough kind, erecting in its course an embankment 20 feet wide at its base, 4 feet wide on top, and 4 feet high. And the land reclaimed by this work produces forty bushels of wheat to the acre, for the subsistence of man; but a short time previously, it was the nursery of reptiles. Nor does the benefit end here; for, previous to the subduing powers of the steam-ditcher, it was worthless; but, reclaimed by its aid, at the small cost of $2 an acre, we find the same acre, in one year, appreciating to $15 an acre. How few investments can show such results!

One of these machines is described as now at work on the farm of Mr. Charles F. Reed, and is of the following dimensions and construction: It is 41 feet long, 12 feet wide, and 12 feet high; has an upright boiler 8 feet long, attached to which are two engines of 7-inch bore and 12-inch stroke; which, with one hundred pounds of steam and one hundred and fifty revolutions, give 24½ horse-power. The machine stands on four wheels. The forward or propelling wheels are eight feet in diameter, with 2 feet face, and are attached to the forward shaft like the driving-wheels of a locomotive. To one of these wheels is attached an internal gear 6 feet in diameter, 5 inch face and 2½ inch pitch, in which works a 10-inch pinion, which is connected with the engine by a combination of gearing so arranged that, by the working of four clutches, the machine can be propelled, either forward or backward, from one to ten miles in ten hours, without increase or decrease of the speed of the engine. The hind wheels are 6 feet in diameter and 1 foot face, and work on a loose crooked axle, similar to the hind axle of our large city trucks. The hind part of the machine rests on a rocker, placed on this axle, to which are attached tiller-chains, which pass around the forward end of the machine, and are worked by a worm-gear with a crank which guides or steers the whole machine.

A few feet forward of the middle of the machine is an iron wheel 7 feet in diameter, to which are attached four knives, angular-shaped, and which extend 12 inches each way laterally. This wheel revolves about thirty times a minute, cutting a ditch 2 feet wide and 4½ feet deep. Upon each side of this cutting-wheel are knives extending from the bottom of the wheel upward and outward, like the sward-cutter of a plow, which trim the outer edge or side of the ditch and give the slope or flare as desired. Following this wheel is a scraper, the point of which comes under the wheel, and extending backward and upward is an apron or belt of India rubber 2 feet wide, upon which the wheel drops the dirt, cut and finely pulverized. This is carried back and up to the rear of the machine, when it drops to a top or side apron, which carries it to either side of the ditch. This side apron is arranged so that it will carry the dirt either to the right or the left by moving a clutch. As the cutting-apparatus is working, the whole machine is moving forward, and the quantity of work it does is regulated by giving it a fast or slow motion forward, without changing the speed of the engines. The machine weighs about seven tons, and costs about $5,000, or just about the cost of five able-bodied negro men before the war, and by whose labor we

have seen that it cost from $100 to $150 an acre to reclaim land such as the steam-ditcher reclaims at only $2 an acre.

We have thus far given the experience of others; in almost all that follows we shall give the result of personal experience; and as, perhaps, the great majority of farmers and planters are not familiar with the machines to be mentioned, particularly those of the South, who need them most, we shall be more minute in our description of their construction and operation than at first sight might appear necessary. Our chief aim and object is first to attract attention to their value, and show how much can be accomplished by their aid. Through their agency we have been enabled for a series of years to work a farm of nearly two hundred acres with the assistance of only two little boys and occasional help at harvest and thrashing. First in importance on the list is

THE GANG-PLOW.

To one unaccustomed from his youth to plod the weary furrow behind the plow-handles, this implement is of inestimable value. At one stride it endows the weak and infirm with power, and renders him capable of performing more and better work than the most stalwart farm-hand with the old-fashioned implement. The machine consists of a gang of two plows, whose beams are attached to an axle resting upon two wheels. One of these wheels is so arranged that by means of a lever the driver can so adjust the height of the wheel as that it shall correspond to the wheel running in the furrow, and thus keep the plow-soles on a level in the bottom of the furrow. Another lever on the opposite side, with a catch working into notches on an arc, serves the double purpose of either regulating the depth of the plowing or of entirely throwing the plows out of the ground at the end of a furrow for the purpose of turning around. Upon the machine is provided a comfortable seat for the driver, where he may sit and plow the livelong day, and even smoke his pipe with all the gusto of "Uncle Toby."

Perhaps it may be objected that this looks more like play than work; then let us examine, at the going down of the sun, what this seeming idler has accomplished. Upon examining the work we find that the soil has been thoroughly broken up and turned over to a uniform depth of about 8 inches, and the amount of work done, about five acres, with no balks and hollows, but all looking smooth and level, indicating the thoroughness of the work. To accomplish this has required the power of four horses, and only one man, by which the labor of one man is saved, and the addition of one acre of land plowed.

It may be questioned by what possibility can the two plows of the gang and the four horses accomplish more than two common plows with like four horses? Here science sheds her light on the subject and renders perfectly clear that which seems at first sight obscure. Every farmer knows that the plow has three intense points of friction, viz: the land-side, the sole, and the mold-board. It has been repeatedly demonstrated, by the trial of the dynamometer, that the land-side consumes of the power of the team, 55 per cent.; the sole 35 per cent., and the mold-board only 10 per cent., making in all 100. Therefore it follows that, in proportion as we lessen these points of friction, so do we lighten the draught, and accomplish more work. To illustrate the subject, we have only to recall the important difference of attempting to haul a cord of wood over a dirt-road upon the runners of a sled, or to haul the same upon a wagon. The sled drags, but the wagon rolls. So with the gang-plow; it rolls along on wheels, and thus lessens a large

percentage of friction which the common plow is encountering at every step. Thus has genius given the farmer an implement whereby he can not only do more and better work with less cost and less hands than the old implement, but he thus also has always at command what may be justly called "reliable labor," and renders him perfectly independent of others, if he is willing to help himself.

THE HARROW.

Next in importance to thorough breaking up of the soil is its thorough pulverization afterward, in order that, the soil being well comminuted, the young and delicate rootlets may be able to push their feeders in every direction without obstruction, and thus send nourishment to the plant from every available portion of its elements found in their unlimited search. In the improved sulky-harrow we again witness the triumph of machinery over the old V-shaped implement. It is a well known fact that the old harrow will traverse a plowed field two or three times without doing more than merely scratching and smoothing over the tops of the rough sods, leaving the lower bed full of unbroken clods in precisely the same condition in which they were inverted by the plow. And if the field should happen to be foul, every farmer knows the break-back operation of tramping all day long behind one of these "drays," and being forced to the necessity of constantly lifting the implement over the huge mounds of rubbish rolled up in their path, which, like the snow-ball, "gathers as it goes." Then these unsightly mounds must either be leveled down again, or the tedious operation be resorted to of throwing them into a wagon to be hauled away; otherwise the amount of grit and sticks which accumulate in their bodies is sure to make sad havoc with the keen-edged blade of its successors, the reaper and mower.

The subject, however, has not attracted as much attention from inventors as many much less important ones. It is evident that to form a complete chain of labor-saving machinery, the sulky-harrow should not be omitted. In connection with our other implements we have worked with very satisfactory results an implement of this character, described in the report of 1869, page 321. This machine subserves the two-fold purpose of both a harrow and a seeding-machine. It requires no previous preparation of the land other than that of ploughing, and is able to accomplish from ten to fifteen acres a day with one man and a pair of horses. The driver is provided with a comfortable seat, from which he guides the team and superintends, without effort, the various operations of harrowing the soil, sowing the fertilizer, grain and grass seed, all at one operation. The harrow proper consists of a cylinder, armed with teeth, which, by means of suitable gearing, is rotated at high speed; which, instead of skimming over the clods, *drive through them* down to the bottom of the furrow, and thus reduce the whole mass of sods to a fine tilth, whereby thorough admixture of the fertilizer and soil is accomplished, and the pulverized seed-bed promotes rapid and even germination of the plants. With this implement there is no rolling up of mounds of trash, but the field is left in the best possible condition for the harvest. And here, again, we may institute the same comparison as before, resulting in favor of machinery; for we find that this machine, with one man and a pair of horses, will do the work of five men and an extra team of horses, and do better work.

THE SERRATED ROLLER.

This machine is of great value to the farmer, who prides himself upon putting his fields in "garden order" before committing his seed to the

ground. In soils liable to bake into hard clods, soon after the process of ploughing, it acts with great effect—completely crumbling them down into powder in its path; and is, on that account, particularly valuable in preparing the ground for the planting of corn, whereby that most desirable feature, a "good stand," is almost invariably secured. It is also very valuable as a successor to the plow where heavy sod is broken up—compressing the furrows down evenly, and partially crumbling the surface, leaves it in the best possible condition for the harrow. And in wheat-culture it is used to great advantage by passing it over the field after the crop is seeded, thereby giving that compactness to the soil so essential to the successful growth of the plant, and materially aids in setting the grass-seeds usually sown with that grain. In England and France it is considered one of the leading machines on every farm where high culture is practiced. The machine is of cast iron, in several sections, around whose peripheries are a series of corrugations, that cut through and break open the clods; it weighs about one thousand pounds.

THE GRAIN-DRILL.

Although, when originally introduced, the drill was supposed to be the *sine qua non* of good farming, nevertheless, with all its good qualities, experience has proved that, it is not under all circumstances, the most advantageous system. Under certain conditions of soil and locality, it is of great advantage in securing a good yield—whereas, under other circumstances, the reverse is the case. Some of the chief objections to the drill are that, where the farmer is pressed for time, or is short of teams and hands, it requires so much previous preparation of the land before the seeding can begin—and, oftentimes, even after all this labor of preparation has been gone through with, a sudden and heavy fall of rain so compacts the finely prepared soil that the tines are unable to penetrate deep enough to afford sufficient covering for the seed; and, consequently, more time has to be consumed in breaking up this crust with cultivators before a satisfactory result can be attained. The clogging of the tubes is, also, a source of frequent annoyance which, of course, is the cause of the skipping over of much land at times, and can only be known when it is too late, *i. e.*, after the appearance of the crop. When, however, the reverse of these conditions exists, and the soil is light, we have in our experience found the drill of very great value in securing good crops. There are some drills, however, that sow the grass-seed in front of the tines. This is decidedly unfavorable to a good set of grass; as the seed is buried beneath the soil at such a great depth that, according to the best tests that have been made, fully one-half rots, or never attains the surface. Where the grass is sown in rear of the machine, the reverse is the case; as it is pretty generally established that the seed is so fine that it needs no other covering than that which is afforded by the first good shower of rain that follows.

In England, where the drill is most highly esteemed, the spaces between the rows are usually cultivated by a peculiar horse-hoe especially adapted to the purpose; and it is there not considered safe to neglect this cultivation, as the opinion is entertained that the great growth of weeds, which otherwise usually obstruct these passages, not only consumes a vast deal of the fertilizing elements, but also, by maintaining an almost constant moisture around the stems of the plants, conduces greatly toward developing that fatal destroyer, the rust. And, indeed, at home it is beginning to be a question among the best farmers whether a heavy stand of grass, seeded down with the grain, does not

materially contribute also to that end. And it is beginning to be the practice to omit the grass-seeding altogether at this period, and only sowing it down, after the removal of the crop, right upon the stubble. The effect of which seems to be that, as there is no overshadowing of the plants, they grow much faster and yield a crop of hay in the same time.

THE REAPER.

No one who values his reputation as a progressive farmer can afford to be without this all-important implement. When, at times, we see the haggard "cradlers," in a field, literally obtaining bread by the sweat of their brow, we are reminded of the man who always preferred the stage-coach to the railway—the one he considered safe, the other liable to accidents. Next in importance to growing a good crop is the securing it with rapidity, ease, and economy. A machine that will cut its ten or fifteen acres a day with a pair of horses driven, perhaps, only by a boy, attended by a few binders, is one of the greatest triumphs of modern farming, emancipating as it does the lady of the establishment from the serious care of feeding the grand harvest army of other days. And a sale of over one hundred and fifty thousand of these machines a year attests the high esteem in which they are held. But candor compels us to admit that the implement can never be considered as having reached its highest state of completeness until it can do its own binding by automatic mechanism. We do not for an instant doubt that this great desideratum will be sooner or later accomplished, and then we shall have the sight of a boy and a pair of horses harvesting a field of grain with only a couple of attendants to secure the sheafs into shocks, and thus we may realize the old proverb, "to safe bind is to safe find."

So many different patterns of this machine are made, that of course, it would be invidious to make any distinction. All are more or less perfect in their way; while it must be admitted from experience that the largest proportion of wrought iron and the least possible amount of cast iron, should enter into the construction of a machine which has frequently to undergo such severe strains. Strength, with reasonable lightness, is the chief point for the farmer to investigate.

There is another form of harvester used to some extent in the [illegible] States and California, known as headers. This machine in traversing the field only clips off the heads of the crop, leaving the straw standing in the field. The heads are conveyed into a kind of van, and are either sharpened up into shocks or conveyed direct to the thrasher. For the dry climate of California, a machine which would cut, thrash, and clean the grain, at one operation, might perhaps be of greater value even than the header. It would doubtless require eight or ten horses to draw it, but this would be no more than are now required by the thrashing-machine, and the operation of cutting would be a clear gain. Or, doubtless, such a machine could be handled to advantage by the steam-traction-engine used for steam-plowing.

Indeed, if we are to credit history, the headers appear to claim antiquity over the reapers; for Pliny, the elder, informs us that, "in the extensive fields of the lowlands of Gaul, vans of a large size, with projecting teeth on the forward edge, are driven on two wheels through the standing corn by an ox, yoked in a reverse position, with the machine forward of the ox. In this manner the heads or ears are torn off and fall into the van." This was nearly two thousand years ago; and to come nearer down to our own period, not quite a century since we learn of a machine in Great Britain that was propelled by a horse hitched in its

rear, which clipped off the heads as it passed onward through the grain, these falling into a large box in rear of the cutting-apparatus; and, when full, the box was transported to the granary to be thrashed at convenience. In illustration of the high dignity which inventors in England held, it may not be amiss to mention that even the great statesman, Mr. Gladstone, took out a patent for a machine-reaper, which would cut corn and deliver the straw in gavels behind, to be subsequently bound by hand.

In the attempt to render the reaper a really valuable and practical machine, many centuries and the brains of many prominent men were occupied; and America may justly claim the crown in this long contest. The reaper of to-day, a live, practical, and indispensable machine, takes its true parentage from Mr. Obed Hussey, of Baltimore, Md.; McCormick, of Virginia, following close upon the heels of Hussey, carried it forward almost to its present state of perfection.

THE HORSE-RAKE.

The beautiful picture of Ruth gleaning in the fields of Boaz, however picturesque in effect, has now been rendered a plain matter of fact and a business operation by the introduction of the horse-rake. Perhaps no machine on the farm is of greater importance, in its way, than this modern implement. And, in a money point of view, it surpasses them all, literally more than paying for itself in a single season. Simple of construction, light of draught, and effective in operation, any boy who can drive a horse can manage it and make himself as valuable in the harvest as the ablest man. Passing rapidly over the stubble of the wheat-field, it leaves in its wake huge gavels of valuable grain, which, when taken to the thrasher, speak eloquently through the bushel-tub of a gain, the prospect of which, at first sight, would seem to have been "a game scarcely worth the candle."

This machine has nearly altogether superseded the old wheat-gleaner which, itself, was a great advance on the ancient system of hand-raking. [illegible]r are its services alone confined to the gleaning of stubble, for it is [illegible]dispensable companion of the mower in the hay-field—saving, by [illegible] of its movements, thousands of tons of hay annually which, othe[illegible]ight be caught by storms and irretrievably ruined. It is also a valuable adjunct in the old corn-field, gathering up in its folds the corn-stalks cut down to make way for the seeding of oats, and laying them off in convenient piles to be hauled away to the compost-heap to be rotted down into manure.

The machine consists of a light frame, resting upon two wheels, surmounted by a comfortable spring-seat for the driver. In rear is a huge comb of spring-teeth, of semicircular form, depending from the axle, and a stiff counter-comb extending backward, between the spring-teeth. When the machine is in motion, the spring-teeth, hanging downward to the ground, rake up all the loose straw in its path, and as soon as a gavel of proper size is formed, the driver touches a lever at his side, which quickly elevates the comb, and the counter-comb above presses the gavel out and delivers it, while the spring-comb drops down to its work again. The machine is furnished with thills and only requires the service of a single horse.

THE THRASHER.

When we compare the insignificant little affair, which, but a short time ago, was almost in universal use, requiring such a concourse of

hands to clear away the trash and dirt it made while going through the melancholy operation of killing up a half dozen horses a day, it is difficult to realize how much ingenuity and skill have been expended on the modern thrasher, so simple and perfect is its operation. Machines ranging from two up to ten horse capacity, and, indeed, as is now getting to be quite the custom, accomplishing even one-third more work under the driving force of steam, are to be seen on every well-regulated farm, receiving the sheaves at the cylinder and rendering the grain cleaned at the bag ready for its immediate shipment to market; while at the same time the elevating-carrier is passing the well-cleaned straw up to the man on the stack, and the riddles are carefully turning out the tail-ends for the winter benefit of the poultry. No dirt, no confusion—everything goes on like clock-work, and more particularly so if the steam-engine is on the ground. We are doing twice as much work, twice as well done, and with half the hands of the "old machine." This is progress.

THE MOWER.

What the reaper has done for the farmer in the fields of grain, the mower has also accomplished in the fields of grass; and any considerable farmer finding himself without a mower to-day would be seriously jeopardizing his reputation for being a man of progress. But as well known as this machine is to the farmers of the Northern and Western States, it is as yet an unheard-of thing at the South. But it is reasonable to hope that, with the changed systems of things there, and the painful experience of the past years in the heavy losses sustained by planters depending upon one staple alone, it will gradually, but surely, attract general attention to a more diversified system of agriculture; whereby not only the planter himself will be individually benefited, but permanent improvement given to the soil in the shape of sod, instead of the present scourging system of an incessant cultivation. That "all flesh is grass," is to no one more striking than to the successful cultivator of that herb. Its abundance on his own estate gives muscle to his teams, fat to his steers, butter and milk to the dairy, wool to the shee[illegible] mutton to his table, and a general abundance of God's good gifts.

In no department of agricultural machinery has more tast[illegible] skill been displayed than in the get-up of mowers. Machines ar[illegible]rned out exhibiting in their construction almost the same care and perfection of details as a sewing-machine, and of such simple construction, and lightness of parts, as only to require a person of ordinary ability to operate and a light pair of horses to draw them. It is estimated that in fair grass, on a moderate-sized farm, one of these machines will pay for itself in a couple of seasons; and, with proper protection from the weather, and ordinary care, should last eight or ten years. We have had ours in use about eight years and it is still almost as good as new.

As previously alluded to, in conjunction with the mower is used the horse-rake, whose operations, however, are preceded by

THE HAY-TEDDER.

This is another one of the long list of machines which has added incalculably to the wealth of the country. By means of this implement, hay can now be cured and safely stored away in the barn, within the same day that it is cut, thereby altogether avoiding the old-fashioned risk of cocking it up in the fields for the purpose of curing. The machine, somewhat like the rake, consists of a light frame, mounted upon

a pair of wheels, supporting a comfortable spring-seat for the driver, who has nothing to do but guide his horse. An eccentric crank-shaped shaft is mounted with a series of levers, armed below with spring-teeth. The ends of the cranked shaft have pinions that are actuated by an internal gearing in the driving-wheels. The result of this ingenious combination is that, when the machine is driven over the newly cut grass, these several levers, with their spring-forks, go to work very much after the fashion of a hen scratching for food for her chickens; and, by this movement, the grass is rapidly opened and tossed into the air, and falls again upon the stubble as lightly as a snow-flake. By this process, the air is permitted rapidly to circulate under the swath, and the sun is able, in a short time, by striking through, to cure the hay quickly, thereby retaining all its fine color. With one of these machines a boy can cure from twelve to fifteen acres a day. Some of these machines are made with arms something like a revolving-harrow.

In a couple of hours, after this process, the horse-rake comes into operation for the purpose of rolling up the swath into convenient gavels, and then, if the barn is convenient to the field, the services of a wagon may be entirely dispensed with by bringing into play

THE HORSE HAY-SWEEP.

This machine is very light and simple of construction. Attached to a pole, for the draught of two horses, is a wide rake of wooden teeth lying flat upon the ground, with a lever in rear to be used by the driver in discharging its load at the barn or at the start. Thus, as soon as the hay is in a condition to be removed, he drives the machine athwart the gavels formed by the horse-rake, and in the encounter the machine loads itself, and is then driven off to the point required; and the driver, upon arriving there, by actuating the lever, permits the rake to upset itself and thus discharges his load and returns to the field. At this point of the process another invaluable machine is brought in which saves, perhaps, one of the heaviest operations of haying, and that is the raising of the hay to the mow, or loft, and storing it away. In lieu of the old and fatiguing process of "pitching," modern farming enjoys the great advantage of

THE HORSE HAY-FORK.

There are a number of different styles of this machine, but nearly all are constructed, more or less, on one common principle. A block and tackle, with the fork at its lower end, is attached by suitable means to the building, or to poles if stacking out of doors. The fork, or harpoon, is driven into the hay, and, by automatic action, secures itself to it; while a horse, attached to the fall of the rope, is driven off and thus, by means of the tackle, elevates the charge to any desired point, where it is received by the person stowing or stacking. At this moment a trip-cord is pulled by the man below, which immediately frees the fork and releases the hay. With this machine a couple of men are able to do more work in a day than a dozen or more in the old-fashioned pitch-fork style. These forks are usually made of steel, are light and not expensive. Nor are their services confined to haying, for in stacking or housing grain of various sorts they can also be used to much advantage.

Although the long list of labor-saving farm-implements which we have already enumerated are of incalculable advantage to the farmer, still the labors of the inventor would have been far from complete had he overlooked the great, and perhaps most important, crop of all to Americans—the crop which sustains man and beast—and omitted to furnish us with

THE SULKY CORN-PLANTER.

This machine, got up almost with the lightness and elegance of a phaeton, is of the first importance on the farm, and is brought into requisition at that critical season when not a moment can be lost without incurring a corresponding diminution in the harvest. It is composed of a light frame, mounted on wheels, and furnished with a seat for the driver. The wheels are very broad in the tread, and answer the two-fold purpose of locomotion and rollers for covering and compressing the earth around the corn. In front is a transverse frame, to the center of which is attached a pole for a pair of horses. Secured to either end of this cross-bar are two steel swords, not unlike a cimeter in appearance, that cut into the soil and form an entrance for the drills which are in rear. Over the drills are two hoppers, containing each corn sufficient for several acres planting. At the bottom of these hoppers are holes with slide-valves for dropping the corn down into the drills. These valves are operated by a connecting-rod, which is moved by a pitman actuated by a pinion meshing into an internal gearing in one of the wheels. The driver rests his feet on two stirrup-like bars, and, by more or less pressure, controls the depth to which the sword-drill plants the corn. Suitable devices are arranged for regulating the distance apart between the hills and the number of grains to be dropped. The machine is so constructed as to be capable of planting either in checks or drills. If used in the former way, it requires a boy to ride with the driver for the purpose of working the dropper; but when planting in drills, only requires the services of a single person. With this machine a man and a pair of horses can plant from twelve to fifteen acres of corn in a day. Immediately after this machine, we call into service

THE SULKY-CULTIVATOR.

This machine, like the horse-rake, is put to various and valuable uses on the farm. Furnished with appropriate and effective shields, the young corn can be worked almost as soon as it comes above the ground without injury from clods. Like its predecessor, the corn-planter, it works with great dispatch and is very effective; a man and a pair of horses being able to work from ten to twelve acres of corn, cotton, or tobacco in a day. After the first working, the shields are removed, and the dirt can be either thrown from or to the plant, and it is mounted upon wheels in such a manner that the corn-crop can be laid by with it at a height of four or five feet, without injury to the stalks. The machine is composed of a light quadrangular frame, mounted upon high wheels, with a pole for two horses and a driver's seat. Four shovel-plows are pivoted to beams that are, in turn, pivoted to the forward part of the frame. The plow-beams are supported by two pendants, which, by means of pin-holes above, regulate the depth of the work. A lever next the driver enables him instantly to raise the plows out of the ground at the end of a row for the purpose of turning around and in order that no damage may occur. If roots or stones are encountered below the surface, the standards of the plows are held in position by wooden pins, strong enough to overcome the ordinary resistance of the soil, but which immediately break upon encountering any unusual obstruction and free the plow from injury.

This machine is also very valuable for cross-plowing land in the spring which has become packed during the winter; and for this purpose there is an extra shovel, which is adjusted in front of the four, and

thus forms the V-shape necessary for the purpose. It is also used to great advantage in breaking down the old corn-beds in the spring for seeding the field in oats; which it also covers in very effective style and with great expedition. And, for this purpose, some of these machines are provided with a seed-hopper in front, which is worked by means of a chain, orother device, operating from one of the wheels.

Next on the list should be the

CORN-HARVESTER.

A number of patents have been granted for this implement, but we are unable from experience to say whether their operation has been such as to pronounce the implement a success. It is, however, one of the farmers' greatest wants, and we trust that it will not be long before the corn-harvester will be as familiar as grain-harvesters. An implement which would gather the ears from the stalks without imposing the burden of hauling stalks, fodder, and all, unless desirable to do so, would doubtless be regarded with much favor.

THE CORN-HUSKER.

The same remarks will apply to this machine as to the foregoing—a universally-practical one has not, to our knowledge, yet claimed public attention, although several are in the field. The one we tried did not operate as was represented.

THE CORN-STALK CUTTER.

We believe that a number of these machines are in successful operation in the West. It is represented as composed of a light frame upon wheels, with a pole for a span of horses, and a seat for the driver. Suspended to a pivoted frame below is a cylinder armed with cutters. Upon driving the machine through the old corn-stalks, the cylinder is lowered to the ground, which, in revolving, presses these cutters or knives against and upon the stalks, and chops them up into lengths of a foot or so, convenient for being turned under by the plow. The amount of labor required to dispose of stalks in the spring, and the delay and vexation attending it in wet weather, would seem to render this machine of much value, if effective.

THE COTTON-PLANTER.

We believe there are a number of these machines contesting for the palm. But whether any have yet accomplished all that is claimed for them we do not know. We would, however, say to the cotton-planters, do not abandon any invention too hastily which promises to render important aid. Though the earlier efforts may fail, we have all the experience of other inventions to encourage us in the belief that cotton will form no exception to the rule.

We have now passed in review a comprehensive list of what may very properly be termed the power-machinery of a well-conducted and progressive farm-economy, for although many of these implements are apparently costly at first, nevertheless experience has abundantly proved that, by their immense saving of time, wages, and human muscle, they are of the greatest economy in the end, and by their liberal adoption there need be no great complaint of scarcity of labor, for at

every step of farm-labor this Hercules is always present to help those who are willing to help themselves. Science has endowed us with the power of making the weak strong, and the strong stronger, and at less cost of time and labor we are able to make two blades of grass to grow where only one grew before; and, relieved of the toil and moil of other days, we may truly be said to have given a zest and dignity to labor which cannot fail to cause every intelligent man to gratefully appreciate the superior advantages we enjoy in these great gifts of modern farming.

JUTE IN THE UNITED STATES AND INDIA.

Although jute is not produced in the United States to an extent worthy of particular mention, the practicability of its successful cultivation in several of the Southern States and in California is fully established. That it is susceptible of being made a staple and profitable crop in those sections, meeting the requirements of climate and soil, is not any longer a doubtful question. The Department directed its attention to the practicability of introducing jute into this country in the year 1869, and having procured from India, and from France, supplies of seed, a distribution was made for purposes of experiment in 1869–'70. Subsequent distributions have also been made. In the annual report for 1872 the following view was taken by a correspondent of the Department:

"Ramie and jute, fibrous plants which promise great value, have recently been introduced into the United States, and, to some extent, have been distributed by the Department in the Southern States, the climate of which is adapted to their successful production. Of the former, little progress has been made in its use, because machinery has not been invented by which its fiber may be separated; but its value, in view of its fineness, strength, and beauty, will yet command an exercise of ingenuity which will make its culture a profitable industry. The latter has already taken its place in the manufacture of carpets and other fabrics as a substitute for cotton, wool, flax, and hair. Each of these, I may safely predict, is destined to occupy an important place in the products and manufactures of this country; and it is not the least important consideration that they may serve largely to diversify the crops of our Southern States, a subject which has commanded much of my attention because of my conviction of the many benefits which will result therefrom."

In the same report accounts were published which indicated "a growing conviction that the cultivation of this valuable fibrous plant will eventually become a profitable industry in the country." Favorable experiments had been reported from Georgia, South Carolina, Florida, and Louisiana. A South Carolina planter, noting the precarious nature of the sea-island cotton-crop, was convinced that jute, on account of the cheapness and simplicity of its culture, was the proper substitute. In Louisiana, a company entered upon its production on a large scale. Referring to the quality of the jute-product of that State, Mr. H. H. Stevens, an expert in the jute-trade, gave it as his opinion that the fiber, as to length, strength, and color, was fully equal to that of India. In that year also Mr. E. H. Derby, of Boston, who has for many years felt a large interest in the possibilities of jute-culture in this country, and on his own responsibility and at considerable outlay had promoted experiments at the South, wrote to the Department that he was convinced

that the rich lands of Florida, Louisiana, Texas, and Mississippi would, with fair cultivation, yield 3,500 pounds, or ten bales, of fiber to the acre, in place of one-tenth that amount of cotton; and that it could be produced at less than one-tenth the cost of cotton; that the caterpillar would not touch it; and that if planted around cotton-fields it might protect them from that voracious insect. He was also led to believe that jute might attain its full growth in from three to four months, and therefore that the same field might yield two crops in a season. The protection afforded to cotton through surrounding it by a belt of jute has been affirmed by several experiments. In December, 1873, Mr. Le Franc, president of the Southern Ramie Planting Association of New Orleans, La., having noticed the statement that cotton surrounded by jute was thereby protected against the attacks of caterpillars, found, after experiment, that the statement was correct, and says, "There were no worms in the field, although situated in low lands of the suburbs of New Orleans, while some adjacent plantations were visited by the insect. I have also observed that no flies or butterflies ever go to the jute-flower."

In the present summary, the statement of Dr. Landry, of New Orleans, bearing upon this point may be noticed, although heretofore published in the reports:

I have seen, on the 1st of October, a cotton-field in full foliage, flowers and bolls, without a single insect-bite. That cotton was surrounded by a jute-growth. All the other cotton-fields, far and around, were more or less devastated by worms. If this fact does not conclusively prove the protective influence of jute over cotton, it at least contains a great presumption in favor of the affirmative, as the emanations from the jute-flower are injurious to the insects. Paris-green has succeeded generally in saving the cotton, wherever it was properly applied; but the jute would cost less and be more reliable, on account of the uncertainty of negro labor in disseminating the green poison over the cotton-leaves.

Mr. William M. Hazzard, of Georgetown, S. C., in 1872, in addressing the Department in regard to an experiment with jute, said:

The cultivation of rice is attended with so many difficulties and risks, and such an outlay of money, with little or no remuneration, that we shall be obliged to abandon our lands, or introduce some plant less liable to the disasters to which a rice-crop is exposed. From experiments I have seen made, I am satisfied that our lands are well adapted to the growing of jute. This plant, whenever tried in the rice-fields, has grown most luxuriantly.

The plan pursued in the rice-fields of India—that of alternating rice and jute, to the advantage of both crops, and the re-invigoration of the land—is referred to in the review of the East India system which forms a part of this article.

A correspondent at Charleston, S. C., reports that he planted jute-seed June 10, on very poor land, and about October 1 the plants had grown to a height of 6 feet. That it can be raised at the South with success and at a large profit he has strong faith.

The following extracts from correspondence published in the monthly report of the Department for November and December, 1872, will indicate the progress made in experiments:

Orange County Florida.—I plowed up and thoroughly prepared a half acre of medium-grade pine-land, and sowed the jute in drills May 23. It came up well, but owing to the excessively hot, dry weather it all dried up. On the same day I sowed a small plat in a bay-head. It came up and grew finely. I am now gathering the seed. Some of it is 12 feet high, and all as high as I can reach, showing that on damp, rich soil it will here succeed finely. This bay-head is muck, several feet deep, which I cleared off and limed two years ago. Upon it bananas grow from 12 to 15 feet high.

Muscogee County, Georgia.—I consider the experiment in jute-raising a success. The cultivation is simple and the cost of production small. I had seeds sown broadcast on broad beds; some on sandy river-land, and the rest on stiff clay-land. The latter did very much better than the former. The cultivation was the same, but many of the plants on the sandy soil died out after having attained their full growth, while those on the clay-lands remained green and vigorous and matured their seed. The plant requires moisture. The seed was sown in May, and the plants could have been cut in September. A frost, on the 15th of Oc-

tober, which injured the cotton, did not leave its mark on the jute. It attained the height of 15 feet, and in appearance somewhat resembles a plantation of young peach-trees before being removed from the nursery. I had the plants cut in October and steeped ten days in stagnant water, after which the fiber was easily stripped off.

New Orleans, La.—Jute-seed received from the Department of Agriculture was planted on the 11th of April. The soil was well plowed and harrowed and in good condition. Patch No. 1, rich soil, 3 feet above ordinary gulf-tide, planted in drills 3½ feet apart; patch No. 2, very rich soil, one foot above tide, planted in chops 4 feet by 2½; patch No. 3, same as No. 2, planted broadcast; soil very dry at planting. Seed covered one-half inch deep did not germinate until rain on the 22d of April. May 12. Passed the cultivator through patches 1 and 2. May 27. Chopped with hoe the large weeds from the same; jute 2 feet high; no further cultivation. Patch 3 received no attention after planting. Almost continuous drought this summer; jute suffered, but not so much as corn and other crops. July 10. Cut a portion of patches 1 and 2, 9 and 10 feet high; put the same in bayou-water for seven days, and got beautiful fiber the entire length of the plant. July 15. Planted again the land which was cut on the 10th. At this date, October 10, this second crop is 8 feet high, looking well, although it has suffered much excessive drought. Wishing to save as much seed as possible for a more extended planting the next season, I could afford but a fractional part of an acre on which to arrive at some idea of what amount of fiber we may expect per acre. On the 28th of August I cut a portion of patches 1 and 2, plants measuring from 11 to 13 feet; seed-burs about half-grown. (This was in accordance with direction in Agricultural Report of 1871, page 172.) The quantity of fiber saved satisfied me that the yield of these patches would be quite equal to 4,000 pounds per acre.

Patch 3, broadcast, is exceedingly dense and heavy; portions being matted with native weeds, it is impossible to make a reasonably accurate estimate of yield per acre.

Wishing to test the aquatic qualities of jute, I selected patch 2, as liable to overflow by heavy rain. The season being almost entirely without rain, I transplanted some of my July planting, when 2½ feet high, into water several inches deep. The plants have continued to grow finely, and are now looking well; this in a continuous flood of water for several weeks.

The correspondent last quoted, Mr. F. W. Johnstone, said: "The seed we are now gathering appears to be larger than that planted—evidently improved. It takes just 600 of the Calcutta seeds to equal in weight 500 of the Louisiana." Under date of October 22, 1872, he forwarded to the Department three samples of jute-fiber, with a report, an abstract of which is given below. Sample No. 1 was cut four and a half months from time of sowing, when the most forward seeds were half ripe; No. 2, three months from sowing, when the first blooms appeared. This, he thinks, is the best time, as at that stage female labor can do the cutting, and there being then only one quality of fiber, the expense of slow and tedious assorting and of cutting butts is avoided. No. 3 was from the second crop, planted July 15, and cut two months later. He further reported:

Some of the July planting, second crop, is now fully matured for fiber; some planted the first week in August will make a full crop, unless the frost is unusually early. Inquiries from South Carolina to California are being made of me for seed for next season. I have none to spare. Mr. Chapman, of Red River Landing, is asking $5 per pound. He has two varieties, the pod-bearing and the bur-bearing seed. The pod-bearing variety he thinks much superior to the other. This he got, I think, three years ago, from the Department of Agriculture. The seed the Department sent out last spring was exclusively the bur-bearing, which is brown in color, while the pod-bearing is green. I have some plants, which have been flooded constantly for two months, now seeding in six inches of water.

Charleston, S. C.—I have done what I could to encourage experiments with jute, and have distributed hundreds of packages of seed raised by myself. Experiments have been in the highest degree encouraging. The plant seems to flourish quite as well as in India.

The Department having received very favorable accounts of experiments from Louisiana and Georgia, together with specimens of the fiber produced, sent the specimens to Mr. Thomas H. Dunham, of Boston, for comparison with foreign jute. That gentleman, who has shown great zeal in his endeavors to introduce jute into this country as a staple crop, says:

The quality is very superior. The market is just now very much depressed. Some parties here have lost very much on jute-butts, and this season (1872) India goods were imported at immense loss. The present rate is 6 to 8 cents a pound, gold; the usual rate, 10 to 13 cents, gold. Your samples are very superior, and at 10 cents, gold, it would be safe to quote.

Mr. Dunham continues:

You will understand that our merchants do not favor home-growth of jute, or rather, make light of it; but my advice to you is, leave no step possible to push the jute-growth; make every effort to get it raised here. Beyond and above all obstacles push it on. The country will sustain this to any extent. The motive is greater than you can have any idea of. The moment you get the growth started, you will be fully assured, as capital will follow quickly, as in cotton.

Suppose it were a new growth of cotton, no one would doubt the success, or the aid needed. Our growth of jute will nearly equal half the cotton-crop. We can cut off India supplies, as we have done in cotton.

The interests of our merchants are so interwoven with India importations that they will (as they do) say, "You will never get any quantity grown," and make light of it. But your sample shows that its cultivation is feasible, and it must pay when the market changes. All orders to India are stopped now, and the revulsion will bring jute higher here, within the next year, than it has ever been.

A few experiments have been reported during the present year. It will be remembered that the Department sends to individuals only very small quantities of the seed, and that on this account, perhaps, experiments are not, in many cases, conducted with the zeal and energy necessary to a full test of the capacities of soil, &c.

In a recent letter Mr. Le Franc, of New Orleans, says that, in spite of the difficulties and drawbacks which he has had to encounter the present season from heavy rains, overflows, and droughts, he will have 150 acres of jute to harvest, "if the weather be not too unfavorable in September." In some of the fields the stalks, at the time of writing, were 8 feet high, and "as thick as wheat." He mentions, incidentally, the fact that a piece of land which had produced jute-seed last year is now (autumn) in full growth of jute again, though none was planted this year. The seed which dropped last year was sufficient for a new crop.

Mr. Le Franc sent to the Department five specimens of jute and its fabrics raised and manufactured in Louisiana. These consist of jute filament, rolled, after cleaning by machinery; jute-rope, crude or unrotted, as it comes from the machine; and jute rope, made of rotted jute. He asserts that competent judges pronounce the jute to be 50 per cent. better than the India article. These specimens are now in the Department museum.

Mr. C. B. Stewart, of Montgomery, Ala., experimented during the last season. The plants grew 8 feet high and branched widely.

Two experiments are reported from Florida. In Jackson County, jute was tried by itself, and also with cotton in the field. Well-developed stalks, 8 feet in height, were produced. "The plant is well adapted to soil and climate. In Leon County, the jute-seed was planted by several farmers, and succeeded very well. Owing to too heavy covering by some, the stand was not as good as it might have been, but once up, the plant everywhere grew very rapidly. August 12, in different fields, it was from 8 to 12 feet high, and giving no evidence of stoppage of growth."

Another correspondent, same State, who has succeeded well in raising jute, says that if 5 cents per pound can be netted, more can be made by raising jute than cotton. He planted about the 1st of May; the seed germinated freely, and the plants grew finely on rather poor land, attaining a height of over 10 feet by the 19th of September.

In Madison County, Georgia, the stalks grew 8 feet high, but, on account of very late sowing, were killed by frost.

A South Carolina farmer says it grows from 7 to 10 feet high on elevated rice-lands, and is of the opinion that it would prove an excellent crop to destroy volunteer rice (considered the greatest drawback to making good crops) by alternating it with rice, say every two years.

A farmer of Duplin County, North Carolina, gives the particulars of an experiment as follows:

The land was prepared as for cotton; dropped the seed, 12 inches apart, May 1. Land, moist bottom. The spring being unusually wet the seed did not germinate for three weeks, and a good stand was not, therefore, obtained at an early date. The plants grew to a height of 13 feet, with limbs of 5 to 7 feet in length. Plowed twice and harrowed once. Cut October 1, and thrown into water, where it was allowed to rot for three weeks. The fiber was then very easily stripped, from bottom to top. Specimens were exhibited at the State fair, and were pronounced to be "fine" by gentlemen who had seen it growing in India. I think that, by liberal manuring, the bottom-lands in North Carolina could be made to yield as high as 3,000 pounds of fiber per acre. It was troubled by no insects. A cotton-patch by the side of the jute was not invaded by caterpillars, while they destroyed several acres in other fields.

Notwithstanding the fitness of our soil and climate for the growth of fibrous plants, and the constantly-increasing demand for their products, no advantage is taken of the inducements to add to the wealth of the country by means of them; rather, on account of neglect, there is annual loss and reduction. Hemp, jute, flax, and ramie might well become staple crops of the country—keeping within our own borders the millions in gold annually sent abroad for crude fibers and their manufactured products with which we cannot dispense. As appears in not too closely estimated accounts, not less than $30,741,959 (gold) was paid into the coffers of foreign nations in 1873 for imported materials and their products which might have been reaped upon our farms or manipulated in our factories. Not only this, but the diversified soil and climate of the United States, together with cheap lands, afford facilities for production in excess of home demands, placing it within our reach to be exporters to those nations which rely for their supplies upon other and far more remote countries than this; and of the advantages of this trade we have deprived ourselves. Europe depends for her flax principally upon Russia, and distant India fills her treasury with the proceeds of her exported jute—a trade of such large and increasing importance that it is becoming the great staple of Bengal, trenching upon hitherto leading staples, and even upon the production of food-grains.

The conversion of raw flax into any other fabrics than bagging, rope, and other coarse products is not an industry of large importance in this country. According to the decennial census of 1870, the amount of flax used in the manufacture of bagging was 4,672 tons. In the same year 1,927 tons of raw flax were imported, and of manufactured, *by yard*, amounting in value to $12,716,656.

Flax is cultivated in this country chiefly for the seed, which commands good prices from the linseed-oil mills. In view of the scarcity of cotton during the war of the rebellion, efforts were made to cottonize flax, Congress, indeed, having ordered an investigation to be made under the auspices of this Department, looking toward improved methods and cheap manufacture; but the result was one of only partial success. Nevertheless, the immediate effect was to stimulate flax production, and the impetus at that time given has continued a yearly augmentation of crop, but almost wholly for the seed.

An article quoted in the annual report of this Department for 1868, from the annual report of the Missouri State Agricultural Society, contained a statement estimating the flax-crop of the previous season at 2,500,000 bushels of seed and 62,500,000 pounds of fiber, of which less than 3,000,000 pounds were saved and prepared for use. It was stated in the annual report of the Department for 1869 that the manufacture of bagging alone (jute and hemp often entering into the fabric with flax) employed 14 factories, running about 140 looms, while 137 were employed on jute and 90 on hemp—enough, it was supposed, to manufac-

ture the covering for 3,000,000 bales of cotton; at that time it was estimated that four-fifths of our flax-fiber was wasted, and the fact was cited that in that year $23,000,000 was paid for foreign fibers. According to the last three decennial census reports the quantities of flax-seed returned were: in 1850, 562,312 bushels; in 1860, 566,867 bushels; in 1870, 1,730,444 bushels. At the last census the quantity of fiber returned was 27,133,034. The yield of flax in this country varies from 6 to 12 or more bushels of seed per acre, and about 400 pounds of fiber.

From the latest available information it is gathered that in this country there are 18 linen-factories, strictly so called—in Connecticut 2; Massachusetts, 6; New Hampshire, 6; Vermont, 4. The leading articles of manufacture are linen lines, crash, twines, bagging, thread, &c. There are 182 manufactories engaged in converting flax-tow into merchantable commodities, such as yarns, twines, cordage, shoe-thread, carpet-warps, &c.

The following is an exhibit, condensed from the census of 1870, showing the details of the industry in bagging-manufacture:

Establishments	33
Looms	406
Spindles	5,103
Cards	63
Hackles	289
Capital invested	$3,158,101
Hands employed	3,170
Wages	$958,106
Materials:	
American hemp, tons	7,060
Tow, tons	3,058
Jute, tons	5,691
Jute-yarn, tons	112
Flax, tons	4,672
Other materials	$109,413
All materials	$2,624,682
Products:	
Bagging, yards	12,287,922
Gunny-cloth, yards	1,215,000
Cloth, pounds	942,864
Yarn, pounds	767,296
Other products	$473,260
All products	$4,507,664

In view of the wants of the country, the large importations of manufactured articles enumerated, and the facilities at home for both the production of raw materials and their conversion into articles of economic use, how inconsiderable the aggregate of this exhibit appears!

As shown by the Annual Report of the Chief of the Bureau of Statistics for the fiscal year ending June 30, 1873, the following were the importations of the fibers and their manufactured products into the United States—amounts and values:

	Quantity.	Value.
Flax, and manufactures of:		
Raw ... tons	4,171	$1,137,737
Manufactures of, by yard	....	16,271,590
Other manufactures of, not otherwise specified	....	4,156,801
Hemp, and manufactures of:		
Raw ... tons	20,573	3,347,973
Manufactures of, by yard ... square yards	212,651	40,414
Other manufactures of	....	231,707
Jute, and other grasses, and manufactures of:		
Butts ... tons	35,360	1,197,773
Raw ... tons	27,969	1,967,971
Manufactures of, by yard ... square yards	89,102	16,690
Gunny-cloth and gunny-bags, and manufactures of, used for bagging, pounds	9,589,503	404,851
Other manufactures of, not elsewhere specified	....	2,054,430

These figures, to those who are interested in the advancement of agriculture and the building up of manufacturing industries, are not pleasant to contemplate. But the West, and the Pacific slope, must have sacks and bags for the transportation of its cereals and other products, the South, sacking for its cotton. The question is one of no inconsiderable moment, "Can we raise our own fibers, and convert them into needed fabrics, in competition with foreign countries?"

The views expressed by Mr. Charles F. Reed, president of the California State Board of Agriculture, which, in fact, appeared in the last annual report of this Department, are worthy of more than ordinary consideration. He says:

Nearly all our grain-sacks are now made of the fiber of a plant called jute. The principal place of production of this plant is now in India, in the British possessions of that country; and the principal place of its manufacture, not only into cloth, but into sacks, is Dundee, Scotland. The cost to the farmers of California to sack their last crop of wheat (1872) was not less, but probably more, than $2,450,000. At the ruling prices of wheat at the time these sacks were bought and paid for, it required 2,722,222 bushels of wheat, or a little more than one-eleventh of all the wheat produced, to pay for them. This large amount of money, then, was transferred from the profits of the farmer to pay the labor of producing the raw material in India, the freighting of that raw material to Dundee, the manufacturing it into sacks at that place, and, finally, freighting them to San Francisco, and distributing them throughout the State; with the addition of the profits of the merchants, brokers, insurance-houses, &c.

The question arises, how can these enormous expenses be saved in the future? Our answer is, let our farmers produce their own jute, and California labor manufacture it. We here venture the opinion that our rich bottom-lands, particularly those in the southern portion of the State, where the facilities of irrigation are at hand, will produce not only as good a material, but as abundantly, as the best localities in India. Let the farmers at once take steps to secure the seed, and distribute it in small parcels among their numbers for planting and cultivation the present year. The first effect of such an undertaking, so generally entered into, will be the reduction of the price of sacks; and the next will be the demonstration of the fact, that jute is one of the permanent and profitable products of the country. By the slow and discouraging process of individual effort, it has taken years to demonstrate the fact that California is a good cotton-producing country; by such a general effort, one year will settle the question as to jute.

It is not believed that the production of jute can seriously affect the profitableness of the flax-industry. The exhibits of importations show that there is a demand for jute and its fabrics, and that even flax and its fabrics must of necessity be imported, on account of laxness on the part of our farmers and manufacturers. There is room for the production of all useful fibers for home demand, and afterward for export. Jute fills a special place, its most valuable at present that of a cheap material for sacking. Its cheapness, in comparison with other materials for this purpose, must always stimulate production. The statement is made that "the produce of jute far exceeds that of flax, being, it is said, five times as great as that which flax affords." In Ireland, where flax is raised almost exclusively for the fiber, which is largely converted into superior linens, much interest is being manifested as to the introduction of jute into their manufactories. The opinion for a long time prevailed that jute could not be bleached, and on that account could never be made useful as a textile material. On this point a question is here made from a paper lately read by Professor Hodges, before the British Association for the Advancement of Science:

* * * Until lately scarcely any progress had been made in improving the qualities of the fiber, or giving it the whiteness of linen fabrics. The difficulties, however, which retarded the success of jute-bleaching have during the present year been completely removed by the application of methods which are at present in operation at works erected for the purpose by Mr. W. Sibbald Johnson. * * * * In the processes employed, the cloth or yarn, by means of ingeniously-arranged machinery, is made to pass in succession through baths of alkaline solutions and hypochlorites of magnesia and soda, the magnesia used being economically obtained from kieserite, which is found in large quantities in Germany in the kainit deposits, and has hitherto been regarded as but of little commercial value.

If this process fully meets the expectations concerning it, the fabrics into which jute may enter can be very largely increased, and the value of the fiber, therefore, be greatly enhanced.

The efforts of the Ramie and Jute Company of New Orleans, of which Mr. Emil Le Franc, is president, to introduce jute and ramie culture into Louisiana, and to provide methods of cheap decortication, have been persistent, and, as that gentleman claims, successful. At the request of the Department, Mr. Le Franc prepared a very valuable paper concerning these fibers, which was printed in pamphlet-form, and also in the annual report of the Department for 1873. The methods of cultivation in that State are set forth in detail, and may be consulted with profit by those who contemplate experiment or entering upon the cultivation of the fibers treated of.

IN INDIA.

Late in the year 1873, the lieutenant-governor of Bengal organized a commission to inquire into the condition and future promise of jute-cultivation in his presidency. The important inquiries of the survey were to embrace, first, the present production of jute, with the varieties grown; the best soils and situations for the growth; mode and cost of cultivation; rotation practiced; quantity produced, and the effect of various climates and conditions. Second, the extent to which jute-cultivation has increased, and might further be increased; the nature of the soils and climates in which it might be grown; the degree to which soils are exhausted by it, and the degree in which they may be renewed by rotation, flooding, or manure; and the general prospects of the future production of the article. Third, the preparation of the fiber for market, the present modes, and the improvements that might be effected in such modes.

It is premised by the governor, in organizing the commission, that jute is the most important staple of Bengal, and some apprehension is expressed in regard to the probable effects of jute-cultivation in the United States upon the stability of the trade in the staple as now carried on in India. It is said that "the Americans are actively prosecuting the experimental cultivation of jute in various parts of their country, while we are, as a Government, doing nothing to extend it." Touching this point, the commission in their report, now under consideration, express the following views:

> Competition of a serious kind, however, may be apprehended from North America. In some of the States of the North American Union the jute-plant has been very successfully introduced, and has already been found to be more remunerative than cotton. It is very likely that in a short time the bulk of the requirements of the United States will be supplied by home-grown fiber, and the demand on India will fall off—as regards gunny-cloth it has already fallen off—and, in time, American jute will be in a position to compete with the Indian produce in the markets of Europe.

The jute-product is certainly of vast moment to Bengal and a large part of British India. The industry is said to occupy 1 in 66 out of a total population of 2,349,917 in *Mymensing;* about 10 per cent. of a population of 1,533,931 in *Tipperah;* two-thirds in the north and one-fourth in the south, out of 1,714,795 in *Purneah;* 6.29 per cent. of 689,467 in *Bogra;* about 10,000 out of 1,310,729 in *Rajshahye;* one out of ten among 1,488,556 in *Hooghly;* one-fifth of 532,565 in *Cooch Behor;* and 1 in 10 out of 444,761 in *Goolparah.* In *Backergunge* it is said to engage about 1 in 60 out of a population of 2,377,433; in *Howrah* about 1 in 60 of a population of 297,064; in *Jessore,* about one-thirtieth out of 2,075,021; in the *Baraset* subdivision of the 24-*Perguunahs* 5 per cent.

out of a population of 279,303; and in the *Alipore* subdivision of the same district about one-third of a population of 630,736. It must not be understood, however, that attention is devoted exclusively to the cultivation of jute. "It is most generally cultivated by the ryots as a secondary object to fill up a gap in their occupation, or rather as a supplementary article to rice and other staple crops."

The progress of the trade in jute has been steadily upward, rising during the period between 1828–'29 and 1872–'73 from an exportation of 364 cwt., valued at 620 rupees, to 7,255,689 cwt., valued at 42,349,620 rupees, or nearly four and a quarter million pounds sterling; the government in the mean time having extended no aid whatever toward the fostering and encouragement of the interest. At the same time the demand in England has been rapidly growing. Warden, in his comprehensive work on the linen-trade, (1867,) says:

Jute has now become an article of prime necessity in the manufactures of this country, and everything ought to be done to increase the production and improve the quality that money and skill can accomplish. There are many wealthy houses in Calcutta which have a deep interest in the trade, and it is their duty, and it would be greatly for their interest, at once to take steps to instruct the natives in the cultivation of the plant and the preparation of the fiber. The merchants who are buying it daily must know how this could best be done; but done it ought to be, and that without delay. What is wanted from the growers is a fine, pearly-white color, uniform throughout the whole length of the strike, a finer fiber combined with greater strength, and an abundant supply.

As further indicating the extent and importance of jute-cultivation in India, it is shown that the conversion of the crude material into articles of commerce is in a flourishing condition. The quantity of manufactured jute exported shows a large increase during the last ten years, viz: of gunnies, from 28,122,524 pieces in 1863–'64 to 32,767,930 in 1872–'73; in jute, twine, and rope, from 647 cwt. to 5,051 cwt. The commission observe that, "Originally the Americans were the largest buyers of gunny-cloth, but their demand has fallen from 7,195,409 pieces in 1866–'67 to 1,914,104 pieces in 1872–'73. This falling off, however, has been compensated several fold by increased exports to Bombay, Burmah, and other places."

The growth of the exports of jute and its products to this continent is shown below. It is a matter of regret that there is no division of the statistics showing the direct importations to the United States. It may, however, be very safely assumed that the greatest bulk of jute-importation was to this country.

Statement showing the quantity of jute exported from Calcutta to North America from 1828 to 1872–'73.

Year.	Quantity.	Value.
	*M. s. c.	*Rs. a. p.
1829–'30	127 20 0	191 4 0
1830–'31	917 40 0	2,111 13 0
1831–'32	27 15 0	54 12 0
1834–'35†	7 16 0	11 1 6
	Cwt.	
1835–'36	1,579	4,732 0 0
1836–'37	8,084	20,794 0 0
1837–'38	2,503	5,716 0 0
1838–'39	3,941	8,381 0 0
1839–'40	....	....
1840–'41	536	1,003 0 0
1841–'42	9,508	20,851 0 0
1842–'43	6,648	20,542 0 0
1843–'44	201	512 0 0
1844–'45	2,180	4,833 0 0

*The rupee now coined by the British Government in India is worth 44.5 cents. A maund (weight) is 74.666667 pounds = 40 seer = 640 chattac = 3,200 siccs.

† No importations recorded until 1834–'35.

Statement showing the quantity of jute exported from Calcutta, &c.—Continued.

Year.	Quantity.	Value.
	Cwt.	*Rs. a. p.*
1845–'46	2,058	5,399 0 0
1846–'47	851	1,740 0 0
1847–'48	536	1,094 0 0
1848–'49	7,231	14,766 0 0
1849–'50	24,465	61,901 0 0
1850–'51	6,790	22,825 0 0
1851–'52	18,986	63,792 0 0
1852–'53	18,109	58,044 0 0
1853–'54	96,729	304,516 0 0
1854–'55	93,700	304,318 0 0
1855–'56	53,696	200,750 0 0
1856–'57	112,170	458,031 0 0
1857–'58	68,791	258,580 0 0
1858–'59	82,789	309,081 0 0
1859–'60	23,777	88,711 0 0
1860–'61	57,007	213,769 0 0
1861–'62	49,790	208,803 0 0
1862–'63	21,163	125,138 0 0
1863–'64	53,266	292,806 0 0
1864–'65	42,601	266,596 0 0

The following statement specifically includes jute rejections imported into North America from 1865–'66 to 1870–'71, inclusive:

Year.	Jute, cwt.	Value.	Jute rejections, cwt.	Value.
	Maunds.	*Rupees.*	*Maunds.*	*Rupees.*
1865–'66	10 96 654	3 80 463	10 491	9 535
1866–'67	1 10 966	3 99 925	21 411	9 775
1867–'68	91 495	5 00 576	31 887	56 549
1868–'69	1 80 340	11 59 967	1 81 911	4 24 861
1869–'70	1 36 328	8 90 229	2 01 900	6 65 387
1870–'71	1 90 085	14 41 704	9 87 363	12 98 638

In the following exhibit for 1871–'72 and 1872–'73, jute-cuttings* are included:

Year.	Jute, cwt.		Cuttings, cwt.	Value.	Jute rejections—cwt.	Value.
	Maunds.	*Rupees.*	*Maunds.*	*Rupees.*	*Maunds*	*Rupees.*
1871–'72	2 35 643	17 79 590	7 47 939	31 43 799	1 23 149	6 10 256
1872–'73	3 07 718	21 21 684	10 39 953	29 71 400	1 18 942	4 23 105

* In pressing jute into bundles, the lower portion, which is hard and entangled with the woody matter and bark, and, therefore, cut off from the clean fiber, cannot be pressed. This portion is called "jute cutting."

The names given to the plant now most generally known as jute are in India almost as numerous as the districts in which it grows; *pát*,

however, with various prefixes or suffixes, most prevails. As early as 1793 the East India Company sent to England an invoice of one hundred tons of the fiber under the name of *pát*, and it was declared by dealers in that country to be a species of flax superior to any known in the trade. The words *jhout* and *jhot* are names by which it is known in several districts producing the plant. From this fact Dr. Roxborough, interested in the fiber-producing plants of India, applied the name of jute to the plant under consideration, referring to it in an English invoice in 1795 as the "jute of the natives." The words *jhout*, *jhot*, and *jhat* are from the Sanskrit root *jhot*, "to be entangled;" from which comes the Hindi *jhout* and *jhoti* and the Bengali *jhunt* and *jhunti*, "a tuft of hair." The Sanskrit root also implies "to become bushy," and several derived words signify "a thicket," "a bush," &c.; and *juta*, when used as a Bengali word, is pronounced *jut*, signifying "matted hair." The origin of the English designation is therefore clear.

It is proposed in this place to follow the investigations of the commission, or at least to state as fully as practicable the results of their observations, for the consideration of those in the United States who are engaged in the cultivation of jute or have its culture in contemplation. Although the agricultural system of India has been little progressive, and methods of cultivation have not been conducted with reference especially to labor saving, labor being abundant and cheap, yet profit may be derived from consulting the steps and results of any particular industry, extending through many years. With the methods pursued there, jute, as has already been stated, is pronounced the most important crop of the country, and the progress of the industry has kept pace with the increasing demands of manufacturing countries; and these demands have grown as the uses to which jute may be applied have unfolded themselves, and as machinery has been provided.

Concerning the climate and peculiarities of soil best adapted to the cultivation of jute, the commission draw conclusions from personal observation and reports received from both the producing and non-producing districts. The physical character of jute lands varies considerably. High lands, low lands, recent alluvial formations, or *churs*, dry lands, and humid, are all more or less employed in cultivating the plant. On the *churs* and on saline lands and marshes it flourishes well—often in water waist-deep. It is said that the larger portion of the jute which comes from the central and some of the eastern districts is grown on *churs*, and on inferior soils, but that in the *desi* or littoral districts a larger proportion is grown inland than on the banks of the rivers; but it is concluded on the whole, after thorough investigation, that the high or *súna* lands are the best adapted to jute, other conditions being equal, and that the *churs* rank midway between the *súna* and low lands. It grows in soil composed of rich clay and sand in equal or nearly equal proportions, in a soil of sand combined with alluvial deposits, on loam mixed with a little sand, on land which is neither inundated nor dry—if the land be loam, that is, half clay—or in ferruginous soil, half sand. In many districts a clayey soil is considered the most desirable. On the other hand, laterite* and gravelly soil are not adapted to the successful growth of the plant. In several districts, where the surface is for the most part sandy, jute is not grown at all. In regard to favorable climatic conditions the views of the commission are thus expressed:

> The tenor of the local reports and the information gathered * * * * * * alike go to show that a hot, damp atmosphere is most favorable to the growth of the plant. Too much rain at the beginning of the season and early floods are equally destructive to the

* An argillaceous sandstone, in India, of a red color, and much seamed. *Dana.*

young plants, and injurious to the prospects of the crop. Except in low situations, seeds, are never sown until after a shower of rain to help germination. Alternate rain and sunshine are found to be most congenial to the jute plant, but excessive rain after the plant has attained a height of two or three feet will not prove materially injurious, so long as no water lodges at the roots. The water, when so lodged, does not kill the plant, for, as already stated * * * * * jute grows in even waist-deep water. * * * Frequent light showers at first, and heavier rains afterward, with the gradual rise of the rivers, and a fair amount of sunshine, contribute very largely to the healthy growth of the plant. It suffers less injury from excess of rain-fall than from the entire want of it. It is admitted on all hands that drought stunts the growth of the plants, and very often destroys them, if not sufficiently developed. But heavy rains have no such destructive effect, so long as they do not drown the plants, and there is sufficient sunshine to afford the necessary warmth.

The time to prepare the soil for the reception of the seed chiefly depends upon the character and situation of the land. Where the situation is exposed to overflow or great moisture, plowings are begun early, but on high lands the time is much later. The number of plowings is also dependent upon the nature of the soil, the desideratum being the most thorough pulverizing of the soil possible to be attained, and its repeated exposure to the sun.

To show the thoroughness of this preparation and the patient industry of the ryots, it may not be out of place to cite the practice of some of the leading jute-growing districts of Bengal:

24. *Pergunnahs.*—Land broken up from September till November, and plowing repeated at intervals of thirty days till March, when it is plowed five times successively. In another division of the district, the land is plowed in October or November, and then left untouched until May or June, when it is plowed twice or thrice. In the Baraset subdivision the land is plowed ten or twelve times between October and May. In the Barripore subdivision it is plowed five or six times in February and March after the removal of the winter crops. In the Basirhat subdivision it is plowed and harrowed from eight to ten times so late as the beginning of June.

Mymensing.—In some places, plowing between August and October, which is repeated eight or ten times in January and February; land sometimes manured, but with cow-manure only. Not unfrequently lands are plowed twenty-five times.

Hooghly.—Land is plowed from three to five times, twice harrowed and leveled, and once weeded.

Burdwan.—Plowing in January and repeated eight times till May.

Bhangulpore.—Plowed twice in January and February, as often in May and June, and again in July or about the beginning of August.

Backergunge.—Tillage begins in October, when land is prepared for winter crops. After these are gathered, in February and March, the worst jute-land, such as hard, dry soil, overrun with grass, is plowed five times and harrowed twice; ordinary lands four times and one harrowing.

Dacca.—The report from this district says: "The oftener and the more thoroughly the land is plowed the larger is the yield. The time of tillage varies. Friable, sandy soils are plowed as early as March, but the larger proportion only after the first showers of rain in April."

Pubna.—Tillage begins sometimes as early as November.

The short-sighted policy of non-selection of seeds has prevailed among the ryots. In most cases the unthrifty plants in field-corners, which for purposes of fiber are of little or no consequence, furnish the seed for subsequent plantings, nor is any change of seed resorted to in any district, as far as ascertained. These are given as the more prominent reasons for the observable want of improvement in the jute-plant.

In this connection it may not be inappropriate to cite the views of Warden, in his work before alluded to:

The produce per acre [of jute-fiber] is variously stated at from 400 to 700 pounds, but it is very probable that the latter quantity is nearest the truth, if not short of it. Were the land sufficiently enriched with manure suitable to the nature of the plant, and properly prepared for the seed-bed, the best seed selected and sown, and the cultivation in every respect intelligently attended to, there is no doubt that the rich soil of the delta of the Ganges, Burhampooter, and other rivers where the plant is chiefly grown, might be made to yield a greater return. So, in like manner, by the same means, the staple might be improved greatly in color, strength, and fineness of fiber, and the root-ends better freed from the hard, woody bark, which is so detrimental to its spinning properties. Hitherto little has been done to instruct the natives in the cultivation of the plant, and they still grow it much in the same way as their ancestors did a thousand years ago. The preference which a strong, well-cleaned, silky parcel gets in the bazaars, and the relatively higher price which it brings, so far stimulates the growers to produce such jute, but this is not sufficient to obtain the desired end, although there is no doubt some improvement has taken place of late.

For seed, the plants are cut in the fall. The pods, having been gathered, are dried in the sun for four or five days, and then thrashed.

The product per acre of jute widely differs in the districts of Bengal: as low as two maunds to the beegah (about one-third of an acre) in Maldah and Singbhoom; and as high as ten maunds in Goalparah; twelve maunds in Nowgong, Bhangulpore, and Pubna; and from 14 to 17 and even 20 maunds in Dinagepore. In Mymensing it is estimated that a beegah of land yields on an average about 43,200 plants, which is considered as representing more or less the produce in other districts. The commission concludes that the general average product is 5 maunds 14 seers per beegah for the whole presidency, but do not consider this a true index of the actual produce, the average being affected by the scanty produce of a large number of unfavorable districts. Taking the large jute-growing districts alone, the average would be about 6 maunds per beegah.

The quantity of seed sown per beegah varies in different districts from 1 to 6½ seers, (a seer is 1.049423 pounds.)

The mode of sowing is, almost without exception, that of broadcasting; after which the seeds are covered with a thin crust of earth, either by the hand, by a harrow, or by a wooden implement in shape like a ladder. In the Sylhet district the sowing is made in seed-beds, and the seedlings afterward transplanted in the fields. The time of sowing varies, but the favorite months are March, April, and May, governed by soil and situation. Germination takes place in from three to eight days after sowing, at which time the field is in many districts harrowed or weeded, or both. But the time of weeding and the frequency of the operation are different in different localities: sometimes "once or twice;" "as often as necessary after the plant grows an inch or two high;" "when the plant is 9 inches high;" "once weeded on germination, and again when the plants are from 15 to 18 inches in height;" "when the plants are about 5 inches in height;" "when the plants are about 5 inches high the field is weeded and thinned;" "when the plants are 4 to 8 feet high the field is weeded," &c.

Great care is taken to avoid overcrowding, to prevent which the crop is thinned by removing the backward plants. The space usually left between plants is 6 inches; in some districts, from 8 to 10 inches. The plant should be cut when in flower, and just before the appearance of the pods; at such time the quality of the fiber is superior. "The fiber from the woody plants, which have not flowered, is weak, while the fiber from the plants in seed is harsh and wanting in gloss, though heavier and stronger than the fiber of the plants cut in flowers. * * The plant

is generally cut near the root, unless the lower end is overrun with suckers. It is shown that the late cutting practiced in some districts renders the fiber woody and spoils its color. As stated by Warden, some of the jute imported into England is found, on opening the bales, to be greatly discolored and so much weakened as to be scarcely fit for spinning. He assigns carelessness as the cause, and says that after the fiber has been freed from the stem and washed, it ought immediately to be hung up to dry, and never be packed up into bundles until thoroughly dried. Too often the handfuls, after being washed, are laid down wet on the damp ground, and allowed to lie there for a day or two, and sometimes longer. In this stage the great warmth of the climate speedily causes the wet fiber to heat, and this weakens and discolors it. As a preparation for steeping, the plants, after cutting, are generally stacked for exposure to the action of the weather until the leaves drop off, since it is believed that the leaves in steeping discolor the fiber. But in many cases the freshly-cut plants, when made into bundles, are thrown into water. Stagnant water is generally considered the best, especially that which contains decaying vegetable matter. In the rotting process, fear of the sand in a running stream is apprehended. On the other hand, the commissioner of Chittagong is quoted as saying that the quality of fiber depends on the description of water in which the plant is steeped. The Buldakhal jute claims its superiority simply because of the contiguity of the river Megna, which affords facilities and good water for steeping purposes; but in Sarail, as recourse is had to pools and stagnant ponds, the fiber is deficient in glossiness, fineness, and color. An official of Tipperah is of the opinion that tidal (running) water is preferable to stagnant, as the fiber in the former case is stronger.

In the process of rotting, the stalks when placed in the water are covered with some material, such as the refuse tops of the jute-plant, brush, light timber, &c., for the double purpose of keeping them under water, and of warding off the sun's rays. But in some places the stalks made into bundles are sunk perpendicularly, the heavy root-ends keeping them in that position, leaving the upper ends exposed above the water. This is continued for ten or twelve days, when the upper parts are pressed down to a level with the root-ends. Sometimes the bundles are turned over while steeping. The rotting process requires from two or three days to a month, being regulated by the kind of water used, and its temperature, whether in a stagnant pool or in running stream, and by the condition of the plant when cut, whether in flower, when the bark is tender, or in seed, when the pith of the bark is hard. Under-steeping leaves runners and pieces of bark adhering to the fiber, which is found "to separate unequally and to stop chiefly at the small knots which appear on the stem." The result is to leave black specks on the fiber. Oversteeping impairs the strength and flexibility of the fiber, and gives to it a dull, muddy color. Examination of the plants undergoing the process must be frequently made, so that when the fibers readily peel off the bundles may be at once taken out, and the process of fiber-separation be begun. Very often, in the absence of pools and streams, the stalks, when cut, are tied in bundles, and then put into tanks filled with impure or dirty water, where they are allowed to ferment until the bark is sufficiently rotted to admit of the easy separation of the fiber. The usual practice of separating, and the one most generally followed, is to shake the stalks in the water from which they are being removed until the glutinous substance in the bark is washed out. It is a matter of indifference whether the stalk be held by the top or the

butt end. The following is a description of one of the processes of eliminating the fiber, given by Mr. Henley, formerly a merchant of Calcutta:

> The proper point being attained, the native operator, standing up to his middle in water, takes as many of the sticks in his hands as he can grasp, and removing a small portion of the bark from the ends next the roots, and grasping them together, he strips off the whole with a little management, from end to end, without breaking either stem or fiber. Having prepared a certain quantity into this half-state, he next proceeds to wash off; this is done by taking a large handful, swinging it around his head he dashes it repeatedly against the surface of the water, drawing it through toward him, so as to wash off the impurities; then, with a dexterous throw, he fans it out on the surface of the water, and carefully picks off all remaining black spots. It is now wrung out so as to remove as much water as possible, and then hung up, on lines prepared on the spot, to dry in the sun.

The method of separating the fiber, or rather the treatment of the plant preparatory thereto, is similar to that practiced by the farmers of Great Britain in preparing flax-fiber. At the same time an English authority, Professor Hodges, says that the produce of jute far exceeds that of flax, being, as generally stated, five times as great.

The method of separation practiced in the district of Julpigoree is thus described:

> After having soaked in this manner, [to a proper degree,] the stalks are brought to the surface, bundle by bundle, and the owner, or his servant, standing in the water, seizes the bundle at the smaller end (*i. e*, top end of the plant) and bends double a portion of it about a foot in length; by doing this the inner stalks break, while the fiber outside, which by the action of the water has got detached from the stalks inside it, remains firm. The operator then takes the broken portion (*i. e.*, the foot length) firmly in both hands, holding thereby the fiber and the broken portion of the stalks. Keeping this portion in his hands, he allows the bundle to float straight before him in the water, and, by a series of steady jerking pulls at the portion he holds he gradually separates the whole length of fiber from the stalks, the fiber coming off from the stalks in the way a stocking does from the foot, if pulled from the toe. The whole length of the fiber being thus detached, the whole bundle of long white stalks is thrown out on the dry land. Renewing the action and holding now the fiber only, and not the broken end, the fiber is easily pulled off the remaining broken bits of stalk.

The fiber is now washed in clear water and afterward exposed to the sun for drying from one to five days. It is then ready to be made into hanks for market.

Having given in detail the existing methods of cultivating and preparing jute, the commission are led to suggest improvements in these respects: (1) selection of seed, (2) rotation of crops and observance of fallows, and (3) care and attention in the season of reaping, and in the manipulation of the fiber. To briefly summarize these suggestions: soil intended for the jute-crop must be well manured, plowed, cleaned, and pulverized before it is sown. It should be known that seeds from well-grown plants produce a much better crop than those from weak, ill-grown, and unhealthy plants, and that a change of seeds, and seeds brought from distant fields, are likely to lead to improvement in the plant. The case was cited as long ago as 1808 by an officer of the East Indian government, in a letter addressed to the secretary of the Board of Trade, that "at Salsette, where it would appear *sunn* (*Hibiscus cannabinus*) of the best quality in Hindustan is produced, the ryots never sow their own seeds, but procure every year a fresh supply for that purpose from the Mahratta country or from the Malabar coast." The commission properly insist that what is true of sunn is equally so as regards jute, and inculcating that the first step in advance of the present system ought to be careful selection, and exchange of seeds between different districts. As is done in the case of cotton, depots for the reception and disposal of the best jute-seed might be established. Since jute is on all sides conceded to be a soil-exhausting crop, no high lands should be planted with it oftener than once in two or even three years. The infe-

rior quality of much of the jute which comes into market indicates that the lands have been overtaxed. Jute for cordage should be cut in seed, but for other purposes, such as the manufacture of gunny, carpet, &c., should be reaped in flower. The latter fiber is not weak, while it is soft to the touch and silky in appearance. The superintendent of the Gouripore Mills says, in regard to the general subject, that too much importance cannot be placed upon the facts that the cutting of the jute at the proper time in a great measure determines its quality; that if cut when the plant has just reached its full growth and the flowers begin to appear, the fiber will be strong, soft, and free from hard root, which is so objectionable; but, if allowed to stand until decay sets in, the fiber will be hard and of a brown color, and no amount of care in the steeping will remedy this. Dr. Fleming observes that "instead of putting the plants into water immediately after they are pulled up, they [the cultivators] should first dry them in the sun for two days, after which they should steep them."

In concluding this part of the subject the statement made by Mr. James Gordon, superintendent of the mills above referred to, may be profitably quoted, as also the report by a Calcutta merchant. Mr. Gordon has been in Bengal for ten years, and in the years 1870, 1871, and 1872 grew jute on account of the Gouripore Manufacturing Company. He says:

I grew jute * * * * * * both on *chur* and high lands, and the high-land crop turned out to be much superior to that raised on the *chur* land in strength, length, and color of fiber. The outturn per beegah on the high land was 8 maunds in the first two years, and 7 maunds in the third year; that on the *chur* land was about 7 maunds regularly. The *chur* used to be flooded annually, and I did not put any manure on it. The high land had been manured two years before with cow-dung for sugar-cane crop. I cut the plants on high lands when they were in flower, and those on *chur* land when they were running to seed. The *chur*-land jute was harsh and had long and hard roots. After cutting, I laid the plants with tops and leaves in the field for about two days. In observing this process I had no object, but I simply followed the practice observed in this part of the country, and in Scotland in the case of flax. Afterward I caused the stalks to be steeped in pools and excavations, *i. e.*, stagnant water, and covered them with sods to keep them beneath the surface of the water. They were steeped for ten days, and then the fiber was separated by jerks in the water. The fiber was cleaned in the same water in which the stalks had been steeped and dried for about three days. The fiber was then ready. I grew the long-podded jute. It was the white-stalked variety. The soil of the high land was sandy clay. I did not think of steeping jute in river-water, as I was told that running water hardly rots the bark, and, if it does, it takes a long time. In my opinion jute deteriorates: firstly, by being left standing too long in the field; secondly, for want of sufficient labor to manipulate jute after being cut; and thirdly, in dry years from want of sufficient water in which to steep the plant. Manuring greatly improves jute. Jute should not be grown on the same land for several years consecutively: it is an exhaustive crop, and the land should be allowed to lie fallow for a certain time. In seasons when there is a scarcity of water, people generally steep too many bundles in the same pool, a circumstance which leads to the loss of color. * * * Jute will thrive well in moist ground and in a moist climate.

A Calcutta merchant, who has been engaged in the jute business for thirty years, notes the varieties of jute in order of precedence as to their excellence; the names given are those known in commerce. The best kind is known as *uttariya;* the next as *deswal;* next, Dacca Naraingunge *pát; desi* jute comes next; next in quality is the Janiporey or Pubna *pát;* lastly comes the *deora* jute. *Deora* jute is mostly used for cordage. He says:

The jute in order to be good must be white, glossy, clean, of good strength, and long. Jute grows well on *duas* soil, composed of clay and sand: it may grow on *atalia* (clayey) soil, but little or none grows on sandy soil. The longest jute-plant is 7 or 8 cubits in length. My opinion is that the cultivation of jute is gradually increasing, and this year (1873) it has increased 50 per cent. over that of last year. * * * * * * * The quality of jute is year after year deteriorating, and the cultivators in their anxiety to bring to market a large quantity of jute do not pay attention to the careful preparation of the fiber.

Cereals are generally grown on jute-lands. The growth of jute for three successive years on a piece of land exhausts the soil. Jute is so far an exhausting crop. * * * * * * The preparation of the jute-ground commences in February and March, and the seeds are sown broadcast in April and May. The reaping of the crop begins in August and September. Jute-land is generally plowed three or four times, but as a rule it is not irrigated. Both sunshine and rain are necessary for the growth of the plant. The rent of jute-land is 3 rupees the beegah yearly; each beegah produces on an average 8 to 10 maunds of fiber, and the cost of cultivation and preparation of a maund of jute is from 1 to 2 rupees, including rent.

The native manufactured products of jute are principally cordage, cloth, and paper—the latter to a limited extent—"which under different conditions and circumstances assume very different names." Of the first, the range is large, from the thinnest twist, fit for weaving, to heavy hawsers for large boats; intermediate, are twines and cords adapted to various economic purposes. Gunny-cloth of three distinct varieties (each having grades belonging to itself) are manufactured—thick and close-woven, like good canvas; thin, dense, and close-woven, used by the poorer classes for purposes of wearing-apparel, generally by the women; and thick, coarse, and loosely woven, used for sails, for packing large, bulky articles, or for the outer covering of packages, &c. The process of converting jute into paper is very similar to that followed in the case of rags.

It is stated that the mills at work at the time the commission prepared their report, consumed about 700,000 maunds of the fiber annually, and when other mills then in process of construction had been completed the consumption would rise from 40,000 to 50,000 tons per year. The manufactures turned out by these mills consist of wool-packs, twill-bags, and plain bags, of which 25 per cent. are reserved for local use, and 75 per cent. exported to Australia, Burmah, Colombo, Madras, and Bombay.

The commission directed very particular attention to the subject of the effect of jute-cultivation on the soil. The sixteen districts in which jute is principally grown comprise an area of 22,498,477 acres of arable land, of which only 876,324 acres were devoted to jute in 1872. It is thought that were the demand for jute to double in the course of ten years it would take up only about one-thirteenth of the arable area. In addition to the cultivated and cultivable lands, there is a vast extent of reclaimable lands. The continued fertility of these vast tracts, to avoid the disasters attending exhaustion, was, therefore, an inquiry of great moment. The language of the commission on the subject is as follows:

It is a well-known law of nature that all plants are in one sense injurious to the soil, inasmuch as they cannot grow without abstracting some of its constituents, and thereby rendering it poorer than it originally was; and the jute-plant forms no exception. After a careful and mature consideration of the local reports, and of the evidence of the large body of agriculturists and experienced persons whom the commission have personally consulted in the several jute-growing districts, I* have no hesitation in saying that jute does more: generally speaking it exhausts and impoverishes the soil to a much greater extent than other crops. In the absence of a sufficient series of chemical analyses of jute-soils under different conditions, before and after the raising of a jute-crop, I am unable to say what are the particular constituents of the soil which it abstracts; but that it does abstract some of its constituents very largely is evident, from the necessity which agriculturists find themselves under of re-invigorating their fields with manure and fresh earth collected from drains and other places where vegetable and animal decomposition have deposited a rich layer of mold, or leaving them fallow for a time, or by a rotation of crops, the crops being such as are known by experience not to require the same soil as the jute. In the case of *churs*, *bheels*, and low lands, this artificial re-invigoration is not required, as the silt deposited by the overflow of rivers, the washings of the lands brought down by rain-water and deposited on low ground, and the enormous mass of vegetation which rots in *bheels*, effect by natural processes what the agriculturist on high lands has to accomplish by his own labor; but the necessity of applying to the soil those

* The report was written by Baboo Hem Chunder Ker.

constituents which the jute-plant abstracts exists everywhere. Nor are the adverse opinions [quoted in the report] really opposed to this deduction; for it may be that in those places where the soil appears not to be exhausted the rain-fall and drainage are such as to obviate the necessity of artificial manure; or the soil there may be so rich in those particular constituents which promote the growth of the jute-plants that a succession of crops does not appreciably exhaust it: nay, it may adapt the soil for the better growth of other crops. As to the degree to which the soil is exhausted by the cultivation of jute, I am disposed to concur with the collector of Jessore, that ordinarily even virgin land which has been broken up for a first crop will, in the second year, lose about 25 per cent. of its productive power; and that even though afterward heavily manured, its yield in the third year will be about one-half of the first year's crop. It is from this conviction of the exhausting power of jute on soil that this crop is so frequently shifted from field to field; and I can testify from my own observation and inquiries that, except in the case of *churs* flooded annually, and very low lands which derive similar benefits by drainage, it is in a very few instances only that jute is grown on the same land for more than three years successively.

The remedies for exhaustion as generally practiced are three: first, application of manures; second, rotation of crops; third, allowing the land for a given time to lie fallow. The manures commonly used are cow-dung and weeds from overflowed lands, ponds, &c., ashes, house-sweepings, oil-cake, burnt roots of old jute-plants, and the stubble of rice-crops. The leaves of the plant itself which fall off and rot on the ground serve also as a manure; in Nowgong the dried leaves, branches, and stems of the old plants that rot on the ground are considered by the people as the "best manure." Rotation is practiced to a greater or less extent in all the jute-growing districts, but there is no uniformity of system. "Different crops are sown in different seasons of the same year, and for two or three years, or on alternate years, according to the caprice or the necessities of the cultivators, and then the jute is dropped for a year or two when it will no longer grow to advantage."

The crops most generally chosen for rotation are mustard, rice, tobacco, linseed, and various descriptions of vegetables. The practice of several districts cited by the commission may be referred to as illustrating the system of rotation to some extent. In *Bogra*, the jute is not cultivated on the same piece of land for more than two, or at the most three, years in succession. Mustard is frequently sown on the land after the jute-crops are cut. The land is then sown with rice and other seeds for two or three years, when it regains its fertility, and can then be sown with jute. In *Midnapore* the rotation after the removal of jute is (1) some sort of inferior grains; or (2) *khomya*, a kind of cotton; or (3) sugar-cane, and then jute again. In some parts of the district, jute, then some kind of pulses;* then paddy or sugar-cane, and jute again. In *Hooghly* an inferior description of *aus* paddy, as well as the real *aus* paddy and pulses, is usually rotated with jute. The pulses form a second crop in the same year that the jute is sown; but when *aus* is alternated with jute it takes its place. It is in fact the *aus*-paddy land on which jute is grown; owing to the difference between the two seasons respectively necessary for the jute-crop and pulses, both the crops are grown on the same land within the year. In years in which jute is not cultivated on a certain land it is cultivated with the *aus* paddy, and it usually depends on the nature of the demand and the price in the market for the ryots to choose whether to cultivate paddy or jute in a certain year. In some places indigo is rotated with jute.

Burdwan.—After the jute has been cut, winter cereals, or mustard, pease, and the like are sown, but they cannot be said to be in rotation with jute. On the same land this plant is not grown for more than a year, as it exhausts the productive power of the soil. *Aus*, or sugar-cane, which really takes the place of fallow, is sown the next year in rotation.

*Leguminous plants, such as beans, pease, &c.

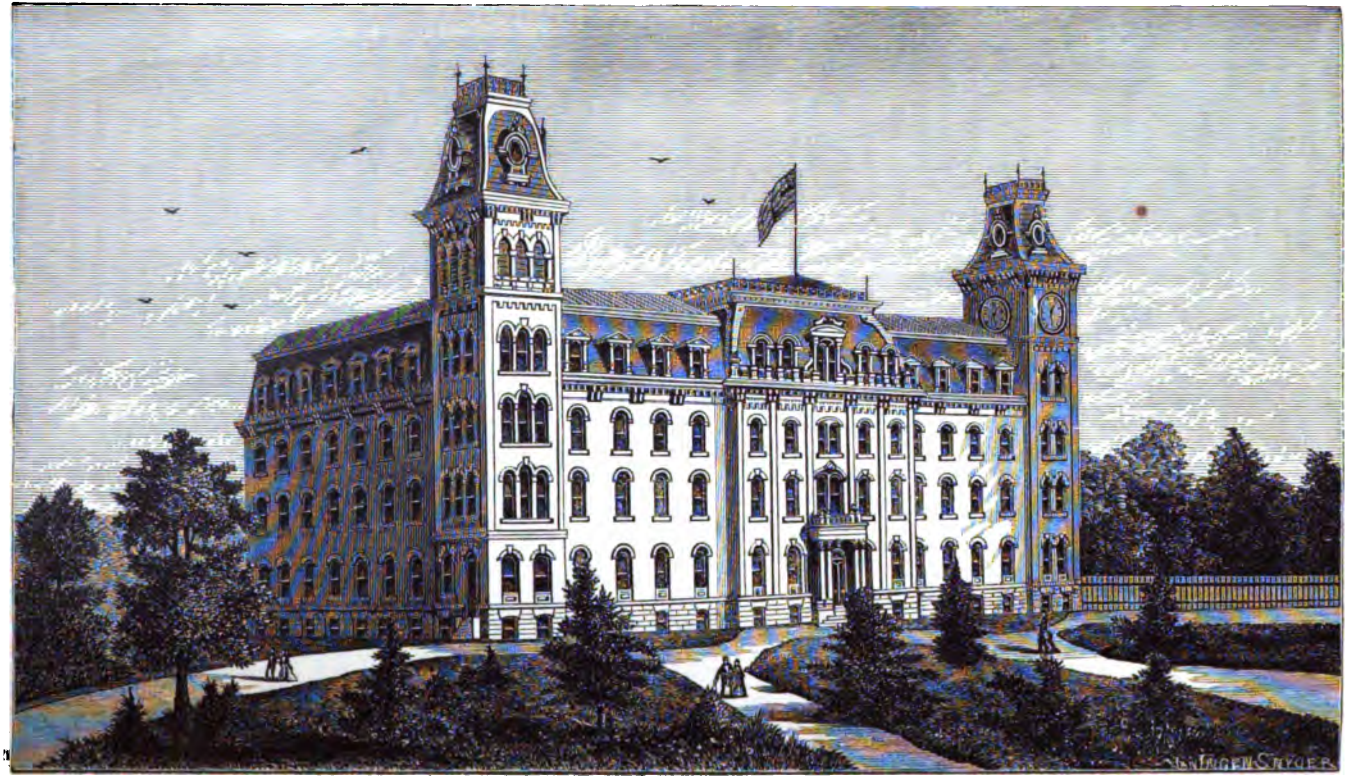
Relating to practiced or proposed labor-saving methods of eliminating the jute-fiber, the commission object to the plan of breaking the stalks by passing them through a mill such as is used in pressing out the juice of the sugar-cane. The disadvantages cited are: first, loss by injury of the stalks, which are used, when stripped, for several economic purposes;* secondly, the employment of labor for pressing the stalks under rollers, and the cost and trouble of separating the broken particles of the stalks from the fiber, which will, in the course of the process, remain adhering to it, and, making it woody, will add to the cost of production, and it is considered doubtful if the improved quality of the fiber and its enhanced price would cover the additional outlay. But the commission say:

> The employment of machinery for the separation of fiber cheaply and effectually would doubtless be very desirable, and it would be worth the while of government to offer premiums for machines for the purpose. The primary conditions which a machine for the purpose is to fulfill, are, first, that it must be so cheap that it would be within the reach of the bulk of the cultivators of this country; second, it must be so easily worked that ryots of ordinary intelligence should be able to use it: and, third, it must be so simple that any village smith should be able to put it in order when required. Such a machine would effect a radical change for the better in the present rude and defective process of separating the fiber. * * * * * * Unless its cost be so low as to bring the machine within the reach of ordinary cultivators, it would prove unavailing, as paid factory labor in large establishments will not be able to compete with the private enterprise of cultivators who devote their leisure hours to the undertaking, but who would not tender such leisure to factors.

PROGRESS OF INDUSTRIAL EDUCATION.

In thirty-six States there are now thirty-nine different industrial colleges which have received the national endowment granted by Congress under the act of July 2, 1862. Louisiana has established one during the present year, and it is already in successful operation. Every State, except Nevada, has established one or more. Georgia and Missouri have each two, located in different parts of the State, but belonging to one university. If we count two additional colleges for these States, the number will be forty-one. All are in operation, except those of Florida, North Carolina, and Texas. Those of Indiana and Louisiana have been opened during the present year. The number of professors and assistants employed in them is 435; and the number of students, in attendance is 3,669. Of the land granted by Congress under the preceding act, 12,577 acres have been sold during the year by five States—Iowa, Kansas, Michigan, Minnesota, and Wisconsin—at an average price of \$4.36 per acre, amounting to \$54,835. The number of acres remaining unsold is 1,049,734. There are only ten States which have not sold all their land. They are Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Nevada, New York, and Oregon. Nebraska, Nevada, and Oregon have not sold any of theirs. The disposition of the curators of these colleges during the year appears to have

*The fiber is not the only valuable part of the jute-plant, as the stalks and stems, which are applied to a multitude of uses by the natives, are of great importance to them. They are somewhat like willow switches, beautifully white, straight, and light, though rather brittle. They are made into charcoal for gunpowder and fire-works, and are used for fences, especially for the basket-work inclosures in which betel-pepper vine is cultivated, and which is universally consumed, by nabob and peasant alike. These stalks are also largely used in supplying fuel for burning the myriads of worms which infest the bottoms and sides of the native craft, and which, if not so destroyed, would speedily render these frail vessels nothing but riddles—*Warden*.



ARKANSAS INDUSTRIAL UNIVERSITY.

been to make them more industrial and less literary in their character, and to make labor compulsory and unremunerative, so far as it is educational or designed to illustrate the branches taught; but beyond this to leave it voluntary, and to pay for it according to the amount performed and the skill with which it is executed. A table of statistics, presenting in a condensed form a considerable amount of interesting information connected with the colleges, may be found at the close of this article.

ALABAMA.

Agricultural and Mechanical College of Alabama, at Auburn, Rev. I. T. Tichenor, D. D., president.—This college is making steady and substantial progress, notwithstanding its financial embarrassments, occasioned by the depreciated condition of the state certificates, in which the revenue of the Agricultural College fund has been paid, and the inability of the state to make appropriations for the erection of suitable buildings for the accommodation of the students. There are six more students in attendance during the present than the last year. The farm has been much improved, some additions have been made to the chemical apparatus and library, and the buildings have been repaired. Experiments have been conducted on the farm in the culture of wheat, cotton, corn, grasses, and forage-plants. The largest yield of wheat was 28½ bushels per acre. Orchard-grass and clover yielded three tons per acre at the first cutting. A second cutting was made, but the yield was not noted.

The college has seven professors, a surgeon, and a quartermaster: Rev. I. T. Tichenor, D. D., president, and professor of agriculture; R. A. Hardaway, A. M., civil engineer, commandant, and professor of engineering; Alexander Hogg, A. M., professor of mathematics; W. C. Stubbs, A. M., professor of natural sciences; J. T. Dunklin, A. M., professor of languages; O. D. Smith, A. M., professor of English; Rev. B. B. Ross, A. M., professor of moral philosophy; J. H. Drake, M. D., surgeon; and E. T. Glenn, quartermaster. It is the duty of the surgeon to attend upon the cadets at the college when called upon professionally for that purpose by any of the officers of the college; and of the quartermaster, to have in charge the supplies to be furnished for the cadets, and to issue them upon the order given by the president, at prices fixed by the board of directors.

The number of students in attendance during the present collegiate year is 108, 36 of whom are pursuing agricultural, and 47 mechanical studies.

ARKANSAS.

Arkansas Industrial University, at Fayetteville, Albert W. Bishop, A. M., president.—This university has seven professors and three instructors. During the year, O. C. Gray, A. M., has been elected professor of mathematics and civil engineering; James Mitchell, A. B., professor of history and English literature; Mrs. T. L. Sutton instructress of the training-school; and J. L. Thompson superintendent of the farm. There are six departments in the university: The classical department, the agricultural, the engineering, the commercial, the normal, and the preparatory. The commercial department has been established during the present year, and the course of study occupies two years. Each department has one course of study, except the normal, which has two courses, one of three years and the other of two. The course in agriculture occupies four years, and is as follows:

FIRST YEAR—*First term.*—Algebra, physical geography, manual of farm, free-hand drawing, practical agriculture, lectures, English diction and elocution, physiology. *Second term.*—Algebra, natural philosophy, English diction and elocution, practical agriculture and pomology, free-hand drawing. *Third term.*—Geometry, botany, natural philosophy, manual of farm, practical agriculture and horticulture, free-hand drawing. SECOND YEAR—*First term.*—Geometry, chemistry, botany, general history, lectures on management of soils and crops. *Second term.*—Chemistry, laboratory practice, general history, lectures on breeding, races, history and management of stock, plane trigonometry, mechanical treatment of soils, and drainage. *Third term.*—Mineralogy, surveying, chemistry, qualitative analysis, botany, rhetoric, propagation of plants, seedlings, grapes, and small fruits. THIRD YEAR—*First term.*—Astronomy, chemistry, qualitative analysis, zoölogy, chemical treatment of soils and manures, orcharding. *Second term.*—Geology, English literature, book-keeping and farm records, entomology, farm-engineering, road-making, farm-machinery and farm-architecture. *Third term.*—Logic, physical geography and meteorology, science of government, rural architecture. FOURTH YEAR—*First term.*—Mental philosophy, political economy, rural law and economy, animal husbandry. *Second term.*—Moral philosophy, history of civilization, constitutional laws, fruit-culture, and forestry. *Third term.*—Meteorology, landscape-gardening, veterinary surgery, current history.

The outside of the university building, which has been in course of construction during the present year, is now completed, and the work on the inside will be finished in 1875. The building is made of brick, stone, and iron, and appears as represented in the engraving on the opposite page. Some slight variations have been made in the original plan as briefly described in the Report of the Department for 1871. As now constructed, it is 214 feet long in front, 122 feet depth of wing, 84 feet depth of center, and five stories high. It will contain, when completed, thirty class-rooms, seven lecture-rooms, including chemical laboratory, chapel, and library-rooms, and four offices. It is to be warmed by steam-heating apparatus, with Ruttan ventilation, and will accommodate 700 students.

Some improvements have been made on the farm and some crops raised. Ten acres of corn have been cultivated and fifteen acres of rye, besides beets, pease, beans, onions, carrots, parsnips, cabbages, tomatoes, sweet potatoes, watermelons, muskmelons, cucumbers, pumpkins, and squashes. A considerable amount of labor has also been performed by the students in removing trees, grading lands, and making roads and fences on the university grounds. The labor system is voluntary, and students do not work more than three hours a day, except Saturdays. The compensation for labor is 5 to 10 cents per hour, according to the amount and quality of the work done. The sum paid to students for labor during the year is $966.93. All able-bodied male students are required to engage in military drill twice a week, under the instruction of the professor of military science and tactics. The uniform prescribed consists of a suit of cadet gray-mixed cloth, of the color and quality worn at West Point, and a cap of dark-blue cloth, having the initials A. I. U. on the front, and surrounded by a silver wreath.

Provision has been made this year for 237 beneficiaries. These and the normal students are entitled to free tuition, the former for four years and the latter for three, with the exception that each is required to pay a matriculation-fee of $5. Other students are now charged $10 per term in the collegiate department and $7 per term in the prepara-

tory department and training-school. The number of students in the university during the present collegiate year is 272, 16 of whom are pursuing mechanical studies.

CALIFORNIA.

University of California—Colleges of Agriculture and the Arts, at Berkeley, Daniel C. Gilman, A. M., president.—The faculty of this university has been considerably increased since the last year. Eugene W. Hilgard, Ph. D., late professor in the University of Mississippi, has been elected professor of agriculture and agricultural chemistry; William Ashburner, professor of mining; Edward R. Still, A. M., professor of the English language and literature; and several instructors and assistants have been added. It now comprises seventeen professors, seven instructors, ten assistants, and two lecturers, making the entire number thirty-six. Twenty-seven of these are employed in the colleges of agriculture and the arts. Mr. John D. Hoffmann, the instructor added in industrial or instrumental drawing, which has now become so important as to make it indispensable to high attainments in mechanics, civil engineering, mining engineering, architecture, and naval construction, was educated in the polytechnic school at Carlsruhe, in Germany, and will give instruction in the most difficult branches of that art.

During the present year a new impulse appears to have been given to the operations of the College of Agriculture. A practical course of agriculture is now being prepared which will comprise the orchard, nursery, botanical garden, and arboretum; and other departments will be added as soon as circumstances will permit. Arrangements have been made for a course of lectures on the practice of agriculture, the improvement of varieties of plants and animals, and on the relations of science to agriculture. The "university farm" has been surveyed by a competent engineer, and the proper places marked out for agriculture, horticulture, botanical garden, forestry, roads, paths, and bridges. It is placed under the care of an able agriculturist and well-trained gardener, who has charge of the horticultural work. A portion of the ground has been deeply plowed, subsoiled, cross-plowed, and harrowed. A part of it was sown with oats, but the greater part has been prepared for orchard-land, upon which the following trees, now in readiness, will soon be planted: Two hundred and seventy-five apple-trees, 270 pear, 152 cherry, 91 plum, 173 peach, 40 apricot, 2 quince, and 15 nectarine. In no case are there more than two specimens of a single variety of any of the trees, and in a large portion of them only one. In addition to the preceding, 62 varieties of the grape, 2 of the mulberry, 19 of the currant, 6 of the blackberry, 36 of the raspberry, 36 of the strawberry, and 16 of rhubarb, will be planted. The orchard is designed to be purely experimental, in order to test the adaptation of the different trees to the soil and climate of California. It is intended to furnish, as soon as possible, cuttings and roots, to be cultivated for experimental purposes in various portions of the State; and it is expected that the university orchards and gardens will, in time, afford a reliable catalogue of trees and other plants adapted to the wants of the orchardists and horticulturists of California and even other parts of the Pacific coast. The botanical garden has been laid out, and is in course of thorough cultivation preparatory to the reception of the various plants to be cultivated in it.

Manual labor of the students has been employed, and, so far as it is required about the university buildings and grounds where the students can at present work, preference is given to them, and they receive a proper

compensation for their labor. During the vacations, on Saturdays, and in leisure hours, many of the students have earned a considerable sum toward their support. A printing-office has been set up at the university, and is under the management of the students, with the approval of the faculty. One individual, who does not wish to have his name made public, gave $1,600 toward its establishment. A newspaper called "The Berkeleyan," which is edited and printed by the students, is published monthly at $1.60 per year. It contains sixteen quarto pages and many valuable articles on the work of the university and general literature. Besides learning the art of printing, students receive instruction in telegraphy. An engraving of the Agricultural College building is here given. Eight neat cottages have been built for the use of students, at a cost of $21,600. Two of them are located at a distance from the others, and are designed for young ladies, one of which is already occupied. Also a barn and two convenient propagating-houses, with the necessary appurtenances, have been built. The barn is a model of convenience, and the propagating-houses are very complete.

The geological museum contains the collections of the geological State survey, the Voy cabinet given by Mr. D. O. Mills, the Pioche collection, and many other gifts received from Mr. Louis Janin, from the agents of Wells, Fargo & Co., and from others. There is also a fine collection of California woods, strobiles, &c., presented by Mr. C. D. Voy, a remarkable collection of early stone implements, a full series of Ward's casts, and other articles for the beginning of an agricultural and mechanical cabinet. The diagrams used by the late Prof. H. J. Clark, late of Massachusetts Agricultural College, in his lectures on veterinary science, have been purchased, and a special appropriation of $1,000 has been made for the purchase of Auzoux models, showing the internal structure of domestic animals and plants. The library numbers about eleven thousand volumes, besides numerous pamphlets.

For the encouragement of students in different departments of the university, the following prizes are offered: For the greatest excellence in scholarship of any graduate of the year, the "university gold medal," or its equivalent in money, $125, from the income of the medal-fund contributed by many friends; for the greatest military proficiency of any student, $100, the gift of Gen. D. W. C. Thompson; for the best original English oration on an appointed theme, by a student of the senior class, $50; for the best argument in public debate on an appointed question, by a student of the junior class, $30; for the best composition on an appointed theme, by a student of the sophomore class, $15; for the best declamation of a selected piece of prose or poetry, by a student of the freshman class, $10—the last four prizes the gifts of President Gilman; for the best essay on free trade, by a resident graduate or a member of the senior class, $50; for the best examination in political economy passed by a student of the senior class, $25—the last two prizes the gifts of a friend of the university who prefers not to have his name known; for the best literary production in the Spanish language, by a member of the post-graduate or any of the lower classes, $50; for the greatest proficiency in the Spanish language, by a member of the junior class, $30; by a member of the sophomore class, $20—the last three prizes the gifts of Mr. Charles F. Gopertz, instructor in Spanish; for the greatest proficiency in engineering, by a member of the senior class, $50, the gift of Professor Frank Soulé; for the greatest proficiency in chemistry, by a resident graduate, $50, the gift of Professor W. B. Rising; for the greatest proficiency in mining,

by a member of the college of mining, $50, the gift of Professor W. Ashburner.

The number of students in the university, including all the departments, during the present collegiate year is 228, 43 more than last year. Of this number 94 are in the classes of science, 72 in the classes of letters, and 62 not assigned to classes. The number of young ladies in the university is 37.

CONNECTICUT.

Yale College—Sheffield Scientific School, at New Haven, Rev. Noah Porter, D. D., LL. D., president.—The scientific school has fifteen professors and sixteen instructors; and the college, including all the departments, has forty-nine professors and thirty-eight tutors, instructors, assistants, and lecturers, making the number of the faculty in all eighty-seven. Mr. John E. Clark has been elected to the professorship of mathematics in the scientific school, during the present year. An entire re-organization of the special courses has been made, and will go into operation during the year 1875. In the select course it has been determined, while giving a general knowledge of the elements of several sciences, to make one in particular more prominent than the rest; and geology, as involving to a greater or less extent the study of several, was selected. The two terms of the junior year are devoted to descriptive mineralogy and blow-pipe analysis, and during the same two terms physical geography and astromony are also studied. In the third term zoölogy and botany are begun, the study of both being accompanied with excursions. Zoölogy also extends through the first two terms of the senior year, and during the third term mineralogy is studied. With the beginning of the second year geology is commenced, and continued without intermission through the third term, accompanied at proper seasons of the year with excursions. The general studies previously pursued in the select course will be continued as before the re-organization.

The laboratories for the study of chemistry and determinative mineralogy have been nearly doubled in size. The large lecture-room in the third story of Sheffield Hall has been changed into a laboratory of elementary chemistry, with accommodations for ninety-six students, for the exclusive purpose of furnishing instruction to the members of the freshman class. It is thoroughly equipped, and will be kept entirely independent of every other laboratory. A room previously used for drawing has been fitted up as a laboratory for determinative mineralogy and blow-pipe analysis. Large additions have been made to the zoölogical collections, consisting of dredged marine animals, parts of a gigantic cuttle-fish, (*Architeuthis dux*, Steenstrup,) taken on the coast of Newfoundland, one of the tentacular arms of which is 24 feet long; oysters in different stages of growth; shells, reptiles, insects, crustacea, and echinoderms; and also to the mineralogical and geological collections, including a very perfect pterodactyl from the slates of Eichstadt, Bavaria; and to archæology. The following is a summary of the different collections, as now increased, which belong to the scientific school: Laboratories and apparatus in chemistry, metallurgy, physics, photography, and zoölogy; metallurgical museum of ores and furnace-products; agricultural museum of soils, fertilizers, and useful and injurious insects; collections in zoölogy; astronomical observatory, with equatorial telescope by Clark & Sons, of Cambridge, and a meridian circle; a collection of mechanical apparatus; models in architecture, geometrical drawing, civil engineering, topographical engineering, and mechanics; diagrams,

adapted to public lectures, and instruments for field-practice; maps and charts, topographical, hydrographical, and geological. The mineralogical cabinet of Professor Brush, the herbarium of Professor Brewer, the collection of native birds of Professor Whitney, and the astronomical instruments of Professor Lyman, are deposited in the building containing the other collections; and Professor Eaton's herbarium, near at hand, is freely accessible. The library has received considerable additions during the year by donations of valuable geological and other books. It now contains about 5,000 volumes. The number of scientific journals taken regularly by the school is sixty-eight—ten American, twenty-three English, fourteen French, and twenty-one German.

The state board of visitors, appointed to visit the Sheffield Scientific School during the year with special reference to the department called the "College of Agriculture and the Mechanic Arts for Connecticut," which received the National endowment under the act of July 2, 1862, to report to the general assembly of the state, said: "They have found the school in a high state of efficiency, its number of scholars never larger, its corps of able instructors zealous and faithful, and fully determined to keep it the leading school of science in the country, a position which it is now generally conceded to hold. It is fully carrying out the noble design of its founders and benefactors, and contributes in a large measure to the intellectual culture of the State."

The number of students in the Sheffield Scientific School for the present scholastic year is 248; in Yale College, including all the departments, 1,031.

DELAWARE.

Delaware College, at Newark, William H. Purnell, LL. D., president.—This college is steadily advancing, although it has not received anything from the State till within the last two years, and this has been an appropriation of only $2,000 annually. It now has five professors, one adjunct professor, two instructors, and one lecturer. In addition to the lectures given by the regular lecturer of the faculty, twelve other gentlemen have been engaged to give each a lecture on some subject relating to agriculture or literary studies. The professor of agriculture, Theodore R. Wolf, Ph. D., has analyzed forty-eight different commercial fertilizers, and given their fertilizing elements in a table which may be found in the "Circular of Delaware College" for 1874.

Two years ago females were admitted to the college classes on the same conditions as male students, and experience has shown that the movement was a wise one. The president says: "The young ladies who have been connected with the college during the past two years have shown a capacity to understand and appreciate their various studies fully equal to that of the other sex. The generous rivalry which has been excited has been of mutual advantage, and in the classes to which the females have been introduced, admirable order and perfect decorum have prevailed."

During the year the preparatory department has been disconnected from the college and has become a distinct institution. It does the same preparatory work, however, for the college as formerly, and now contains 60 students. In the report of the Department of Agriculture for the last year the students in the preparatory department were included in the number of the college, making in all 83. This will account for the apparent diminution of the number in the college this year; but in reality there has been an increase. If the number now in the prepar-

atory department be added to the present number in the college, the total will be 112, 29 more than last year.

The number of students in the college during the present collegiate year is 52, 8 of whom are pursuing agricultural or mechanical studies.

FLORIDA.

Florida State Agricultural College, Hon. Jonathan C. Gibbs, president of the directors.—The trustees of this college have not been able, during the present year, to make any important progress in bringing it into practical operation. The secretary, Hon. J. S. Adams, says the delay has been occasioned by an unforeseen litigation in respect to the constitutionality of the issue of the Florida State bonds, in which the proceeds, derived from the land-scrip granted to the State by Congress, were invested. This litigation is still pending; but an interlocutory decision has affirmed their validity, and a final decision will soon be made by the legal tribunal which has the subject in charge. The college-fund has been preserved intact, and at the same time increased by the addition of the semi-annual interest, except $1,001 paid for expenses incurred in securing the endowment-fund, at 6 per cent. in gold on the bonds.

During this period of suspense the trustees have been active in securing the largest possible donations to the college-fund, and many liberal offers have been made in different sections of the State; but all are conditional, depending upon the location of the college at the points specified in the conditions on which the donations are to be made. The trustees are sanguine in the expectation that they will be able during the next year to locate the college, and complete the necessary arrangements for putting it into immediate operation.

GEORGIA.

University of Georgia.—Georgia State College of Agriculture and the Mechanic Arts, at Athens. Rev. A. A. Lipscomb, D. D., LL. D., president of the university; William Le Roy Broun, LL. D., president of the college.—Among the improvements made during the present year is the completion of the new laboratory mentioned in the report of the Department for 1873. As now constructed, it contains rooms for four chemical laboratories, as follows: First, a room for qualitative analysis; second, for gravimetric quantitative analysis; third, for volumetric quantitative analysis; fourth, for a private laboratory of the professor. Also one physical laboratory; one large lecture-hall; two class lecture-rooms; two drawing-halls, for engineering department; three offices for professors; three rooms for apparatus and models; one for spectroscopic and microscopic examinations; one for reference-library; one furnace-room for metallurgic processes; a battery-room, and a work-room. Water and gas are supplied throughout the building. Each laboratory will be equipped with all the improved modern apparatus required for illustrating and teaching science. It is estimated that $30,000 will be needed for this purpose. A fine spectroscope, with six prisms, made by Browning, London, has been added to the apparatus.

Various important experiments have been conducted on the farm by the professor of agriculture to test the effect of different substances on plants. Thirty-five different fertilizers have been analyzed by the professor of chemistry, their commercial values determined, and the results published for the benefit of the farmers of the State, who have become

much interested in this subject. Also a complete analysis of the cotton-plant has been made, including the lint, seeds, bolls, leaves, stem, and roots, and the constituents composing each part have been given. Careful experiments are being made to determine the increased solubility of ground bone-phosphate by composting it with stable-manure and cotton-seed. These experiments will tend to the solution of a question of great economic interest to the entire South, namely, whether bone-phosphate, ground sufficiently fine, will be so decomposed and rendered soluble in the waters of the soil by the action of stable-manure and cotton-seed, or by either, as to answer all the purposes of southern agriculture. All these experiments are given in full in the report of the college for 1874.

Tuition is now made free to all students residing in the state, and forty-eight counties are represented in the college. There are eight professors and three instructors in the College of Agriculture, and the number of students for the collegiate year is 132, all of whom are attending to agricultural or mechanical studies. In the university there are 13 professors, 3 instructors, and 266 students, not including North Georgia Agricultural College; including that, 23 professors and instructors, and 428 students.

North Georgia Agricultural College, (a department of the preceding university,) at Dahlonega, Hon. David W. Lewis, A. M., president of the college.—This college has 5 professors and 2 instructors. One professor has been added to the faculty since the last report. Such has been the success of this college financially, that the trustees have been able to increase, by about $3,000, the amount paid to the professors and instructors collectively for their services during the present year. Fifteen acres of good land are now owned by the college, and arrangements have been made by which instruction will be given to students in practical agriculture on the farm during the next year, to illustrate the branches taught in the recitation-room. Several of the students have given some attention, during the present year, to gardening as a source of support. The deficiency in education of a great majority of those who have thus far entered the college has prevented the professors from entering so thoroughly into the teaching of chemistry, agriculture, and the sciences as they have desired; but the number pursuing these studies is increasing, and there are more engaged in them at present than at any former period. It is expected that the legislature of the state will make, at its next session, a liberal appropriation to the college for the purchase of philosophical and chemical apparatus, of which there is at present a great deficiency. The trustees and faculty of the college have full confidence in its success, and are doing all in their power to carry out the intentions of the National Government in making the endowment for its support.

The number of students in attendance during the present collegiate year is 162, 25 of whom pursue agricultural and mechanical studies.

ILLINOIS.

Illinois Industrial University, at Urbana, John M. Gregory, LL. D., regent.—There are 9 professors, 4 instructors, 2 teachers, 10 assistants, 1 lecturer on veterinary science, a farm superintendent, and a head farmer belonging to this university. The special instructor in agricultural chemistry, and the 2 teachers, one in domestic science and the other in wood-carving and water-colors, have been added to the faculty during the present year. The university is constantly ex-

tending its work and facilities for instruction. It has thirteen schools: A school of agriculture, horticulture, mechanical engineering, civil engineering, mining engineering, architecture, chemistry, natural history, English and modern languages, ancient languages and literature, military science, commerce, and domestic science and art—each of which has its course of study, and is furnished with the best apparatus, of its own and of European manufacture, for illustrating its several departments of study. It is contemplated to refit the old university building, and devote it entirely to the use of lady students, and to the school of domestic science and art, and schools for women.

The publication of a magazine, called The Illini, has just been commenced in connection with the university. It is to be issued ten times a year, in numbers, each containing thirty-two pages, under the management of a committee, consisting of two members of the faculty and several students from the various schools of the university. It is devoted to industrial education and the literature and science of to-day, and its object will be to represent fairly the university from which it emanates, to give information concerning it, to record the work accomplished, to give the results of investigations and experiments, and the application of learning to the practical arts and affairs of life.

A gallery of fine art has been purchased during the year, embracing more than three hundred casts of ancient and modern sculptures, statues, busts, and bas-reliefs, and over four hundred pictures, engravings, and photographs of master-pieces of paintings in European galleries. It cost $2,500, and its object is to aid in imparting instruction in the school of architecture and design connected with the university. The number of acres of the congressional land-grant which remain unsold at the present time is 25,440. No land has been disposed of during the present year. Board for male students can be obtained in boarding-clubs, formed by the students, at $2 per week. For the coming year board, with unfurnished room, will be provided for female students for $3 per week; with furnished room, for $3.50. The maximum expenses for male students, for the collegiate year of thirty-six weeks, at the university, exclusive of books and clothing, are $213; the minimum, $122.

The number of students in the university during the collegiate year is 406, 316 of whom are gentlemen and 90 ladies. One hundred and fifty of the whole number pursue agricultural and mechanical studies.

INDIANA.

Purdue University—Agricultural College, at La Fayette, A. C. Shortridge, president.—This university was opened for the reception of students September 17, 1874. Richard Owen, LL. D., resigned the presidency in March of the present year, and A. C. Shortridge was appointed to take his place. The faculty has been largely increased, and now comprises six professors, including the president: J. S. Hougham, professor of physics and industrial mechanics; W. B. Morgan, professor of mathematics and engineering; John Hussey, professor of botany and horticulture; H. W. Wiley, professor of chemistry; and Eli F. Brown, professor of English literature and drawing.

During the year there have been completed a military hall and gymnasium, boiler and gas house, stable and shed, and a workshop. The military hall and gymnasium is a frame building 100 feet long, 50 wide, and one story high. It is used for military drill and gymnastic exercises, and cost $6,410. The boiler and gas house is built of brick, and

is complete in all its parts. It has facilities for generating steam and gas for the boarding-house, dormitory, laboratory, and adjacent buildings; and an engine and force-pump with sufficient power for forcing all the water necessary for the buildings and carrying the machinery of the workshop. The gas-holder connected with the building has a capacity of 9,000 cubic feet. The building, with all the appurtenances, cost $34,009. The stable and shed form one compact and connected building, ornamental in appearance and convenient in internal arrangement. The workshop is small, made of wood, and cost $1,000. A small brick house and barn were erected a few years ago by Mr. John Purdue on the one hundred-acre lot, donated by the citizens of Tippecanoe County, and cost $2,500. The boarding-house, mentioned in the report of the Department for 1873, is a brick building, in Italian style, 120 feet long, 68 feet deep, and three stories high, being flanked with a tower at each of the two front angles. The foundation of the main university buildings was laid some two or three years ago as stated last year, but the superstructure remains to be completed. The entire cost of all the buildings with their appurtenances thus far erected, including the foundation of the main university building, is $139,560. They are situated on an elevated oblong plateau containing 100 acres, being a second bank or terrace west of the Wabash River, of great beauty and commanding a magnificent prospect of the picturesque scenery which surrounds them. The grounds have been surveyed, and portions of them marked out for a botanic garden, orchards, vineyard, and small fruits. Some of the orchard-trees have already been set, and the remainder will be planted early next spring, as will also the grapes and small fruits, and about ten thousand shade and ornamental trees which are now in the nurseries and ready to be transferred to the university grounds. One thousand dollars have been donated for building a plant-conservatory and hot-house in connection with the botanic garden. A well-selected engineering, chemical, and philosophical apparatus has been provided, and the geological and mineralogical cabinets formerly belonging to Dr. Richard Owen, former president of the university, have been purchased and placed in the institution. Also an appropriation has been made to purchase books for a reference library.

Five hundred and twenty-six dollars have been paid for live stock for the farm, $265 for farm-implements, $996 for farm-improvements, and $4,388 for improvements on university-grounds. There have been raised on the farm the present year 474 bushels of oats, valued at $182.60; 30 bushels of tomatoes, $15; 7 bushels of sweet potatoes, $7; 110 bushels of common potatoes, $99; 500 cabbages, $25; 50 tons of hay, $600; 800 bushels of corn, $400; and pasturage, $91; total $1,419.60. The expense of production, including everything, was $659.77, leaving a net profit of $759.83. The fund derived from the sale of the congressional land-scrip has been preserved intact, and now amounts to $365,000, having been augmented by the sum of $152,762. The $60,000 appropriated by the State legislature in 1873, payable in two installments of $30,000 each, have been paid, and $75,000 of the $150,000 donated by Mr. John Purdue, to be paid in yearly installments of $15,000, have been paid, being all that is due up to the present time.

Four courses of study have already been prepared: 1. A course in agriculture; 2. A course in chemistry; 3. A course in civil engineering; 4. A course in physics and mechanical engineering. Post-graduate courses can be pursued if desired. The course in agriculture embraces the following branches:

FRESHMAN YEAR—*First term.*—Algebra, English language, drawing,

physics, and physiology. *Second term.*—Algebra, first half; geometry, second half; English language, drawing, physics, first half; chemistry, second half; physiology, first half; and botany, second half. *Third term.*—Geometry, English language, book-keeping, drawing, chemistry, botany, and elements of agriculture. SOPHOMORE YEAR—*First term.*—Plane trigonometry and surveying, business forms, specifications, drawing, English language, botany, and chemistry. *Second term.*—Surveying and spherical trigonometry, English language, farm-machinery, chemistry, botany, and physical geography. *Third term.*—English language, geology, chemistry, meteorology, horticulture, and propagation of trees. JUNIOR YEAR—*First term.*—Logic, ancient history, geology, analysis of soils, economic botany, land-drainage, irrigation, and mechanical cultivation of soils. *Second term*—Logic, history, origin of soils, natural and artificial fertilizers, propagation, budding, and grafting fruit-trees; management of nursery and orchard, fences and hedges, landscape-gardening, and principles of farm-management. *Third term.*—English literature, history, principles of zoölogy, domestic gardening, grapes and small fruits, management of bees, management of poultry, and principles of farm-management. SENIOR YEAR—*First term.*—Descriptive astronomy, Constitution of the United States, stock-breeding, entomology, drawing, plans and cost of farm-buildings, and stock-raising. *Second term.*—Political economy, mental philosophy, history of cultivated plants, comparative anatomy of domestic animals, and veterinary surgery, horticulture, green-house, wintering stock, sheep-husbandry. *Third term.*—Moral philosophy, dairy-farming, preservation and marketing farm-products, veterinary science, rural law, review of sources of pleasure and profit in farm life.

Tuition is free to all students within the state; others are charged $120 a year. Matriculation fee for the full course is $10; room-rent, fuel, and lights, $5 per term; janitor's fee and incidentals, $5; board, $3 per week; washing, 75 cents per dozen. The number of students in attendance in the university during the present year is 56. All pursuing the course in agriculture are required to participate in the experimental operations of the farm.

IOWA.

Iowa State Agricultural College, at Ames, A. S. Welch, LL. D., president.—This college has eight professors, two assistant professors, six instructors, and one lecturer. During the year a new course of study has been prepared in addition to those already established. It occupies one year, and is designed for those who desire to get a general knowledge of the science of agriculture and the operations of the farm, but have not the time to devote to a thorough and systematic course of four years. It embraces farm-accounts, general chemistry, economic botany, management of crops, propagation of plants, seedlings, grapes and fruits, fruit-culture, forestry, insects injurious to vegetation, agricultural chemistry, analysis of soils, history, races, breeding, management of domestic animals, farm engineering and architecture, draining, road-making, water-supply, fencing, and machinery.

A new laboratory-building has also been erected. It is 70 feet long and 40 feet wide. The first story or basement is 11 feet high; the second or main story, 15; the third, 13; and the fourth or attic, 8. The basement contains a first-class engine and boiler, with all the necessary fixtures and machinery for a complete course of mechanics. On the main floor is the laboratory. This floor is continuous with that of the present laboratory, thus making one of the largest and best ar-

ranged rooms for this purpose in this country. The tables will accommodate one hundred students for experimental work in chemistry, organic and inorganic, and are well supplied with apparatus for a thorough and practical course in chemistry. There is also a large room for quantitative analysis. The next or third floor is devoted wholly to the department of physics. Large experimental, apparatus, and recitation-rooms are conveniently arranged, and afford the best facilities for the prosecution of studies in this important science. On the attic floor is a large and brilliantly-lighted drawing-room, besides rooms for meteorological and other purposes. It is believed that this building affords the very best advantages for the pursuit of the studies mentioned. The legislature of the state appropriated $25,000 for its erection.

Experiments have been made on the experimental farm with Michigan white wheat, and Surprise, Probestier, and Excelsior oats, the latter of which yielded 53½ bushels per acre, being the largest product of the three. There have been raised on the farm during the year 4,146 bushels of corn, 361 of wheat, 984 of oats, 214 of rye, 245 of potatoes, 21¼ tons of roots, 140 tons of hay, and an abundance of vegetables, which have supplied the boarding-hall of the steward's department of the college. Of the grounds of the department of horticulture and forestry, which has been distinctively established during the present year, and has for its object the impartation of practical instruction in the management of nurseries, orchards, forestry-plantations, hedges, vegetable-garden, ornamental grounds, and flower-garden, there are 7 acres in forest, 8 in orchard, 3 in small fruits, 6½ in vegetable-garden, and 6 in nurseries. There have been planted 10,600 green ash-trees, 2,000 yellow cotton-wood, 3,000 European larch, 500 catalpa, and 1,000 honey-locust. Special attention is given to the study of botany. Students in the sophomore class recite three times a week in structural botany during the first term of the course, and attain such proficiency in the analysis of plants as to be able to classify most of those with which they come in contact. In the second term, those who intend to pursue the subject further spend two days each week in the study of the more difficult natural orders, as a preparation for the studies of the junior year. Of the land granted by Congress to the state for the endowment of the college, under the act of July 2, 1862, 1,000 acres have been sold during the present year, at an average price of $2.78 per acre. The number of acres remaining unsold is 198,262.

The students in attendance during the present collegiate year number 295, 70 of whom are pursuing the agricultural course, and the remainder mechanical and scientific studies. There are 96 ladies in the college.

Kansas State Agricultural College, at Manhattan, Rev. John A. Anderson, president.—An effort has been made during the present year to modify the instruction given in the college, and make it purely industrial in its character, rather than professional. To effect this object, the courses of study have been reconstructed. Some branches have been excluded, others have been introduced, and the whole presented in the order of their practical value. Three professors have been retired, and one added. The literary course has been abandoned. There are now three courses of study—the farmer's course, the mechanic's course, and the woman's course. The farmer's course and the woman's occupy six years each, and the mechanic's five. Each course is accompanied by practical instruction in the subjects taught. In the farmer's course the instruction consists of farm-tillage, use of farm-implements, farm-drainage, propagation of plants by seeds, cuttings, and layers, improvement

of varieties, grafting, pruning, and forest-culture. The farmer's course is as follows:

FIRST YEAR—*First term.*—Practical agriculture, botany, drill in arithmetic and book-keeping, industrial. *Second term*—Practical agriculture, botany, drill in English and penmanship, industrial. SECOND YEAR—*First term.*—Practical horticulture, arithmetic and book-keeping, English structure, industrial. *Second term.*—Practical horticulture, physics, economic entomology, industrial. THIRD YEAR—*First term.*—Comparative physiology, inorganic chemistry, practical geometry, industrial. *Second term.*—Practical agriculture, organic and analytical chemistry, algebra, industrial. FOURTH YEAR—*First term.*—Agricultural chemistry, economic zoölogy, rhetoric, industrial. *Second term.*—Chemical physics, mechanics, political economy, industrial. FIFTH YEAR—*First term.*—Meteorology, economic geology, mental philosophy, industrial. *Second term.*—Mineralogy, logic, practical law, industrial. SIXTH YEAR—*First term.*—United States Constitution, moral philosophy, history, industrial. *Second term.*—Modern history and literature, Butler's Analogy, industrial.

The study of the languages is not required in any of the courses except the woman's, and in that, only the French and German are studied during the fifth year. Full instruction, however, will be given in these languages to all students who desire it. Latin is taught only for a short time, for the purpose of enabling the student better to understand the technical terms found in the sciences; but even in this case it is an optional study, and is continued no longer than is necessary to accomplish the object indicated. Recitations are graded daily upon the scale of one hundred, and an examination of all the classes is made at the close of each month, the grade of which is reckoned in the monthly average as equal to that of five recitations. Any student not attaining an average grade of sixty for two months is promptly dropped to a lower class, and, if there is none, is excluded from college until able to do so.

All the students are required to labor on the farm, in the carpenter-shop, wagon-shop, blacksmith-shop, paint-shop, turning-shop, scroll-sawing, carving and engraving shops, photographing-room, or the sewing, printing, and telegraph departments. Tools of the best quality are furnished them by the college, without charge for ordinary wear. Seven thousand dollars have been expended during the year in equipping the industrial departments. Students receive no remuneration for educational labor, but for other work they are paid 3 to 10 cents per hour. Some pay half their expenses by their labor, and in some exceptional cases the whole. Tuition is free, and there are no contingent expenses, except a charge of 50 cents to those who receive instruction in instrumental music. Good board is furnished for $2.50 per week. Some students, by renting a house and boarding themselves, reduce it to $1.11 per week. During the present year 1,785 acres of the congressional land-grant have been sold, at an average price of $6.93¼ per acre. The number remaining unsold is 35,040 acres. These lands were carefully selected, in 1863, by commissioners, who examined the immense body of Kansas lands then unclaimed. Those chosen were of so good quality, that the commissioners reported that "each quarter-section would make a good farm." In consequence of improvements made near them, often on adjoining tracts, they have been much increased in value, and are very desirable at the prices and terms offered, which are one-eighth cash, the balance in seven equal annual installments, with interest at 10 per cent.; any greater portion of the whole amount may be paid in cash at the time of purchase.

The college has eight professors, including the president, and six assistants. The number of students in attendance during the present collegiate year is 183, 59 of whom are females. All pursue agricultural or mechanical studies.

KENTUCKY.

Kentucky University—Agricultural and mechanical college, at Lexington. John B. Bowman, LL.D., regent.—There are seven professors and one instructor in the agricultural and mechanical college, and in the university, including all the departments, twenty-seven professors and five instructors, besides the two superintendents of the agricultural and horticultural departments. A change has been made in the faculty, by the election of A. B. Crandall, B. S., professor of natural history. A signal-service station, under the direction of W. S. Jewell, has been established in connection with the agricultural and mechanical college, which has afforded it important facilities for making valuable observations in meteorological science. The regent of the university says that the great value of these observations, to the cause of agriculture, has been fully demonstrated in the growing and saving of the crops raised on the college-farm during the present year. A daily record has been kept of the thermometer and barometer, of the direction and velocity of the winds, and of the amount of rain and snow which have fallen. The five societies, connected with the various colleges of the university, have undertaken the publication of a society-paper, called "The Collegian of Kentucky University." It is issued semi-monthly, and conducted by a committee of editors, composed of one member from each society, and an editor-in-chief, chosen by this committee from the members of the university. It is designed not only to make this paper interesting to the student as a repository of college news, but also a source of improvement in English composition to those students who may prepare articles for its pages.

Valuable improvements and experiments have been made on the farm in the production of various crops, and especially in raising root and soiling crops for feeding cows for dairy purposes. The horticultural department has also been improved, and a large number of plants and shrubs have been added to the collection in the greenhouse. The museum of natural history contains about 20,000 specimens, which have been collected principally through the energy and liberality of Regent Bowman. By an act of the state legislature, duplicates of all the collections made by the geological survey of the state, now in progress, under the direction of N. S. Shaler, are to be presented to this college, which will add largely to its usefulness and facilities for illustrating geological science.

The number of students in the agricultural and mechanical college for the present collegiate year is 180, 44 of whom pursue agricultural studies. The number in the university, including all the departments, is 406.

LOUISIANA.

Louisiana State Agricultural and Mechanical College, at New Orleans, Major J. L. Cross, president.—This college was incorporated April 7, 1874, and is called the "Louisiana State Agricultural and Mechanical College." The act of incorporation declares that it "shall be under the control and supervision of thirteen persons, to be known as the Board of Control of the Louisiana State Agricultural and Mechanical College, of which body the governor of the State, the lieutenant-governor, the

chief justice of the state, and the superintendent of public education shall be ex-officio members, and the remaining nine members shall be appointed by the governor, by and with the advice of the Senate, three of whom shall serve for one year, three for two years, and three for three years; and as vacancies occur at the end of one and two years, and annually thereafter, they shall be filled by appointments to continue for the term of three years, which is hereby constituted the regular term of office for the members of said board of control." The act further declares that "to entitle pupils to admission into said college they shall be residents of the state, of the age of at least twelve years, and be found competent in the branches of good English education to enter upon the studies prescribed; provided there shall be no distinction of race or color in the admission, management, or discipline of the institution; and provided further that the board of control may make regulations and restrictions as to the number of pupils admitted, whenever the same may be necessary to secure to any and all the parishes of the state a proportion of the pupils privileged to attend the college." Tuition is free to students nominated by members of the state legislature, each senator having the right to nominate two, and each representative three.

The college was opened temporarily in the Louisiana University building at New Orleans, June 1, 1874; but its permanent location is about four miles east of the city, on the Chalmette battle-ground, in the parish and county of Saint Bernard, where General Jackson fought his famous battle with the British under General Packenham, the 8th of January, 1815, and near where the Jackson monument is erected. The college will be moved to that place as soon as the necessary buildings can be provided for its accommodation. The state owns two hundred acres of land there. It is intended to erect on the college-grounds a college-building, chapel, dormitories for students, and houses for the president and professors; and to improve the grounds with avenues and parks commodious for military drill and gymnastic exercises. It is also contemplated to have a model and experimental farm adjacent to these, provided with all the implements and appurtenances necessary for practical agriculture, stock-raising, horticulture, and fruit-growing. In connection with the mechanical department there will be a workshop for teaching the practical art of type-setting, spelling, and punctuation.

The college has three professors and two tutors. Major J. L. Cross, president and professor of mathematics, civil engineering, and military tactics; A. L. Perry, M. D., professor of natural philosophy and chemistry; L. W. Sewell, professor of history and English literature; T. W. Carter, tutor in architectural and mechanical drawing; and Augustus Bernau, tutor in modern languages. Three courses of study have been prepared: An agricultural course and a mechanical course, each occupying four years; and a preparatory course, occupying two years. Evening classes have also been opened, five evenings in the week, for the benefit of young men who are engaged during the day in the various arts and trades. The professors of the college have established a paper, called the "Agricultural and Mechanical College Journal," which is edited by the professors and printed by the students. It is devoted to scientific and practical education in agriculture and the mechanic arts, and is issued monthly. All able-bodied students will be required to perform a small amount of labor for practical instruction. Those who wish to labor more than the amount required will be furnished, to a limited extent, with work for which they will receive a proper remuneration.

According to the report of the board of control, made at the close of the present year, the congressional grant of 210,000 acres was sold for 87 cents per acre, amounting to $182,630. This sum with interest accrued after investment, amounting to $205,280, was invested in Louisiana 6 per cent. bonds, bought at a discount, the number of bonds purchased being 327 of $1,000 each, making the fund nominally $327,000. These bonds, on account of depreciation, have been diminished by 40 per cent., giving the sum of $196,200, on which the state has agreed to pay 7 per cent. interest, semi-annually, and has made an appropriation of $130,800 to make good the loss of the 40 per cent. discount on the bonds. It has also agreed to appropriate $10,000 annually, for five years, for purchasing a site for the college and erecting buildings. The first installment of $10,000 has already been paid. The college also has coupons and warrants for interest on the fund amounting to $22,990, and cash in hands of the treasurer of the board of control to the amount of $11,110.77. The financial condition of the college, therefore, according to the report, is as follows: New consolidated bonds bearing 7 per cent. interest, payable semi-annually, $196,200; coupons and warrants for fractional coupons payable out of delinquent interest tax as collected, $22,990; cash in state treasury and in the hands of the treasurer of the board of control, $11,110.77; appropriation for college site, $10,000; making the sum total on hand and certain, $240,300.77. In addition to this are contingent assets which are considered certain, the only contingency being whether the state legislature will or will not squarely perform the obligations of the contract assumed. They are as follows: Appropriations provided for in section 6 of the act incorporating the college, to pay deferred payments for site, $40,000; appropriations to make up loss sustained by scaling $327,000 down 40 per cent., $130,800; making the total contingent fund $170,100.77. The entire property of the college, as thus estimated, including the certain and the contingent fund, is $411,100.77

The number of students in attendance, for the part of the present year during which it has been in operation, is 60.

MAINE.

Maine State College of Agriculture and the Mechanic Arts, at Orono, Rev. Charles F. Allen, D. D., president.—There are now six professors, one assistant professor, and a farm superintendent connected with this college. Some changes have been made in the faculty since the report of last year. Alfred B. Aubert, B. S., has been elected professor of chemistry, and Lieut. W. S. Chaplin professor of modern languages and military science, in place of Randall Whittier, resigned. The services of the lecturers on dairy-farming and on market-farming and gardening have been discontinued. Additions have been made to the chemical, astronomical, engineering, and natural-science apparatus.

A new barn 150 feet long and 50 feet wide, with posts 24 feet in length, has been completed during the year. The roof is slated and surmounted by two large and well-proportioned ventilators, and there are eight glazed windows in each side of the building besides those over the great barn-doors. The barn is clapboarded and painted of a drab-color, with trimmings of a darker shade. The main floor is 14 feet wide and runs lengthwise from east to west through its entire length. The south side is devoted to stables for stock, and provision is made for tying up twenty-six head of cattle. The floor on which the cattle stand extends back from the manger 5 feet 3 inches to 4 feet 9 inches, according to the

size of the cattle, and inclines 1 inch to the rear. In the rear of the floor is a trench 20 inches wide and 4 inches deep, for receiving the excrement and urine, which are passed into the cellar through trap-doors in the bottom of the trench. The stall partitions are carried back from the front of the manger to posts two feet in the rear of the stanchions. There are also four pens, 16 feet long, 3 feet wide, and 3 feet high, placed in the rear of the stables against the side of the barn, for storing sawdust and other bedding for the cattle. On the north side of the main floor are the stables for bulls, the pens for calves, the hospital-room, the stairways leading to the cellar below and to the ventilators above, the room for farm-implements, the granary, and the passage-way to the farm-house. The cattle are fed from the main floor, through doors ingeniously arranged in the partition in front, which may be opened and closed at pleasure. The cellar under the building is deep, and constructed with two drive-ways on the south side, so arranged that a cart can be driven in through one and out through the other. There is also in the cellar a brick cistern, capable of holding 300 hogsheads, for supplying the cattle with water, which is raised by a pump in the barn, and conveyed to a trough, where the cattle are watered. Adjoining the cistern is a root-cellar, inclosed by brick walls, and accessible by a stairway. It has a trap-door, by which the roots may be passed from the main floor, directly to the place of deposit. The remaining part of the cellar is used for collecting and composting manures, and for manufacturing compost from muck and other substances. The cellar and stables are ventilated by wooden tubes, 4 feet wide and 1 foot deep. There are four of them on each side of the building, which pass up against the sides to an opening at the top, formed by a wire-netting under the eaves. The hay is stored on the scaffolds on each side of the main floor, to which it is conveyed by a horse hay-fork. The building is so thoroughly ventilated, that none of the exhalations from the manure-cellar or stables can reach the hay, cistern, or root-cellar, and no injury can, therefore, arise from these sources. The entire cost of the barn is $8,000.

Continued experiments have been conducted in feeding swine with cooked and uncooked Indian-corn meal, confirming the previous trials that uncooked meal is preferable; with different varieties and modes of planting potatoes; with drilling wheat as compared with sowing broadcast; and in the use of different kinds of commercial fertilizers, a full account of which will be given in the report of the college for 1874. Several full-blood cattle of the Ayrshire, Durham, and Jersey breeds have also been purchased for the farm.

The number of students in attendance during the present collegiate year is 121, 18 more than the last year, all of whom pursue agricultural or mechanical studies.

MARYLAND.

Maryland Agricultural College, near Hyattsville, General Samuel Jones, president.—During the year the faculty of this college has been increased, by the election of Capt. William H. Parker, a graduate of the United States Naval Academy, and formerly an instructor in that institution, to the chair of mathematics. There are now six professors and one instructor in the college. It was found necessary to make some changes in the plan of instruction, and the courses of study have, therefore, been modified, for the purpose of making the college more definitely a practical and technical institution, rather than one for a general and classical education. A special course of study has been added to those already

adopted, with the object of fitting students for admission into the United States Military and Naval Academies. A limit of study has been fixed, below which students will not be received into the college. This has had the effect to diminish somewhat the number of students, but it has added greatly to the character and dignity of the institution. In order to place all students on the same level, and to give them the same advantages, the trustees of the college have made provision for the free education of all students from the state who may choose to enter it.

The experimental farm has been considerably improved by under-draining, and a new field of eleven acres has been cleared and brought into a good state of cultivation. The professor of agriculture has commenced a series of experiments on the farm, which will be prosecuted with care and exactness. An effort is being made to furnish the farm with the best breeds of live stock and the most improved agricultural implements. It is hoped that, in time, the college will be able to afford the agricultural population of the state the most reliable and valuable account of experiments, not only with stock and machinery, but also with grains, seeds, and fertilizers. The gas-house, which had been burned, has been rebuilt, and gas and water have been introduced into the president's house and the other buildings in which they were needed.

The number of students in the college during the present collegiate year is 91, 47 of whom are pursuing agricultural or mechanical studies.

MASSACHUSETTS.

Massachusetts Agricultural College, at Amherst, William S. Clark, Ph. D., LL. D., president.—No changes have been made in the faculty of this college since the last year. It has eight professors, one assistant professor, and two lecturers. A large number of interesting observations and experiments on plants have been made, under the direction of President Clark, relating to the circulation, flow, and pressure of the sap, the functions of the bark, and the expansive power of growing vegetable tissue. The enormous pressure of sap, caused by molecular force, has been shown by an experiment made with a squash. When about seven inches in diameter, it was so confined in a stout box, with a concave bottom, that the increase of size would be upward. An iron frame was made, fitting easily on its upper surface, and across this frame rested a lever, chained down at its short arm, and weighted on the long arm like a steelyard. The upward pressure was so great that it broke several levers, and at length lifted six anvils and a number of pails of sand, the whole weighing 5,000 pounds. It then became stationary. Accidental wounds made in its skin healed in twenty-four hours, having been covered with a secretion of true cork, the same as found on the cork-tree.

Observations have been made on the growth of the roots of plants. A sugar-maple ran under and lifted a solid block of sandstone containing 24 cubic feet, and probably weighing two tons. An apple-tree on the college farm sent its roots down through a gravel-bed 8 feet in search of water; and a clover-root, which grew on the banks of the Connecticut River, 8 feet perpendicularly. An elm in Amherst extended its roots 75 feet from its trunk. The roots of a squash-vine, growing on the college farm, were washed out by a garden-hose, and the main branches were each found to be 12 to 15 feet long, and aggregated a length of 4,000 feet. One of the seventy nodal-roots, 4 feet long, had 480 branches, and a most careful estimate of the ramifications of its rootlets, based on the actual measurement of one division, showed that

the vine had fifteen to nineteen miles of roots. Allowing fifty-two days for the time it had been growing, it was found that it must have grown 1,000 feet of roots a day, and on favorable days 2,000 feet. The great depth to which the roots of some of the plants named descended into the earth indicates the importance, as a general rule, of deep plowing. One hundred trees have been girdled the present year for purposes of experiment. A red maple, *(Acer rubrum,)* girdled in July, healed over and lived. This was because the space girdled was not wide, and therefore young cells formed on the surface of the wood before it dried, and made a connection for the circulation of the sap over the part girdled. If the space had been wide, the tree would not have lived. Important experiments with fertilizers have been conducted on the farm by Professor Stockbridge. Professor Goessmann, who is also state chemist and inspector of fertilizers, has made a large number of analyses of commercial manures and prepared an elaborate report on the subject, a detailed account of which will be published in the report of the state board of agriculture for 1874-'75.

The number of students in attendance during the present collegiate year is 117, 13 of whom were in the graduating class and received diplomas. All pursued agricultural or mechanical studies.

Massachusetts Institute of Technology, at Boston, John D. Runkle, Ph. D., LL. D., president.—During the year a large building for a drill-hall and gymnasium, 155 feet long and 50 wide, has been erected, of corrugated iron. Also a new mechanical laboratory has been completed, and thoroughly equipped for experimenting on steam and other subjects relating to mechanical studies. Important changes have been made in the courses of study, all of which have been thoroughly revised and put in tabular form, for convenience of inspection and comparison. Three new courses of study have also been added, viz, a course in metallurgy, a course in physics, and a course in philosophy. The number of independent courses is now ten, each of which occupies four years. The studies during the first year are the same in all the courses, but for the three remaining years they are selected for each course, and arranged with reference to the end in view. In the professional courses the scientific studies generally end at the middle of the fourth year. The course for the last half is then made up, and is mainly devoted to professional studies. It would be instructive to publish all these courses in full, but, in consequence of their extent, they must necessarily be omitted. Those desirous of examining them are respectfully referred to the catalogue of the institute for 1874.

The institute has twenty professors, six assistant professors, and eight instructors. The number of students for the present collegiate year is 303, 30 of whom are pursuing the course of mechanical engineering.

Michigan State Agricultural College at Lansing, T. C. Abbot, LL. D., president.—During the year a house for the president of the college, two houses for professors, the three costing $6,440, a greenhouse costing $8,000, and an apiary have been built. Three hundred and eighty-six volumes have been added to the library. William H. Marston has been elected secretary of the college; Charles W. Garfield, M. S., foreman of the gardens, and James Cassidy, gardener. Of the land granted by Congress, 1,879 acres have been sold this year, at an average price of $3.92 per acre. The fund derived from the sales of 66,478.37 acres, the number sold up to near the close of the present year, amounts to $214,875.49, bearing interest at 7 per cent., and yielding an annual income of $15,041, which is applied to the support of the college. The college property, according to an inventory taken for this year, is

valued at $231,206.66, not including the fund derived and to be derived from the sales of the congressional land-grant.

The number of graduates this year is 24; their average age, 22 years and 11 months, and the average cost to each student for the four years' course, including traveling-expenses, clothing, and books, $741.43. A careful record of scholarship is preserved by marks in a scale from 0 to 10. A written examination follows the completion of each study, and those students are recorded *passed* in that study whose examination mark equals 7, while their regular average exceeds 5; or those, the sum of whose regular and examination marks equals or exceeds 13. Students present at less than four-fifths of the class exercises in any study, are required to pass a special and more extended examination, with a standing at least 7. Any student may receive a special examination in any study, and pass upon a standing of 7; but a student absenting himself from the regular examination must pay to the secretary, before each special examination, a fee of 50 cents, which fee is devoted to the increase of the library. No student failing in two studies is allowed to continue in his class, nor is he allowed to take special studies in advance of his class till all such failures are made up.

The college has six professors and six assistants. The number of students during the collegiate year is 121, namely: resident graduates, 4; seniors, 20; juniors, 16; sophomores, 25; freshmen, 45; and specials, 11.

MINNESOTA.

University of Minnesota—Colleges of Agriculture and Mechanic Arts, at Minneapolis, William W. Folwell, M. A., president.—In this university, including all the departments, there are eight professors, four assistant professors, and two instructors, most of whom are employed a part of their time in instructing students in the branches taught in the College of the Mechanic Arts. During the year the regular course in agriculture has been revised, and an elementary course in agriculture added, each of which occupies four years. Mr. Charles Y. Lacy has been appointed instructor in the theory and practice of agriculture, in place of Mr. D. P. Strange, resigned. The library has received an addition of 3,000 volumes, and now contains 10,000 volumes. There are also belonging to the college 120 cadet rifled muskets; two twelve-pounder brass cannon with caissons, and about 500 models of patents received from the United States Patent-Office, besides geological and other collections. Some experiments have been conducted on the farm, which will be given in the annual report of the college.

Of the land granted by Congress to the Colleges of Agriculture and the Mechanic Arts, under the act of July 2, 1862, 4,962 acres have been sold during the present year, at an average price of $5.78 per acre. The number remaining unsold is 59,957. The permanent productive fund of the university is $168,000, which will yield next year (1875) a revenue of about $10,000, and ultimately a little more than $30,000 annually. There is an annual appropriation from the State of $19,000.

Two large buildings, the main academic building and the Agricultural College building, are now in course of construction, and will be completed during 1875. The academic building, in its extreme dimensions, is 187 feet long, 90 wide, and 108 high to the top of the clock-tower. The basement contains the boiler-room, engineer's room, carpenter's shop, cloak-rooms, closets, and store-rooms. The first story above the basement is 12 feet high, and contains the regents' room, president's room, librarian's room, reading-room, library-room, ladies' parlor, work-

room of library, janitor's room, German-class room, professor's study, arsenal, military-science class-room, cloak-room, and room for a Young Men's Christian Association of students. The second story is 16 feet high in the new part and 12 in the old. It contains 6 class rooms, assistant librarian's room, watchman's room, physical laboratory, with apparatus-room attached, and drawing-room for the apartment of civil engineering. The third story is 16 feet high, and contains the auditorium and arsenal hall, 85 by 54 feet, three class-rooms, and two society-rooms. All the rooms in the building are ventilated by a main ventilating-shaft 12 feet wide, 7 deep, and 90 high, which is capable of passing 500,000 cubic feet of air in 30 minutes. The entire building will be heated by Ide's patent steam-heating apparatus, the steam to be furnished by two boilers, each 12 feet long and 4 in diameter, with 60 3-inch flues. Gas-pipes extend throughout the building, and there is a system of sewerage by which all the waste-matter is conducted away from the building and prevented from exerting any injurious effect upon the health of the occupants.

The Agricultural College building is 146 feet long and 60 wide. The basement is 9 feet high, and contains a boiler-room, two cloak-rooms, assaying-room, store-room, workshop, and chemical laboratory. The first story is 14 feet high, and contains a glass plant-house, gardener's room, professor of agriculture's room, agricultural class room, apparatus-room and private laboratory, chemical apparatus room, and chemical laboratory. The second story is 14 feet high, and contains an industrial museum and lecture-hall. The building will be heated with steam, supplied with gas, ventilated, and drained in the same thorough manner as the academic building. The sum of $2,800 has been appropriated for furnishing, with apparatus, the chemical laboratory located in the Agricultural College building.

The number of students in the university, including all the departments, during the present collegiate year is 287; in the College of the Mechanic Arts, 4. No applications have been made for admission to the College of Agriculture.

MISSISSIPPI.

University of Mississippi—College of Agriculture and the Mechanic Arts, at Oxford, Gen. Alexander P. Stewart, chancellor.—During the year Gen. Alexander P. Stewart has been elected chancellor of the university, in place of Rev. John N. Waddel, D. D., LL. D., resigned. The college has five professors and two adjunct professors; the university, including all the departments, eight professors and two adjunct professors. The number of adjunct professors in the university has been diminished from nine to two. The professorship of agricultural chemistry remains to be filled. Prof. George Little, Ph. D., discharged the duties of the professor of botany and zoölogy provisionally.

More than thirty acres of the experimental farm have been under cultivation during the year with tilled crops. Experiments were made in the culture of cotton, corn, potatoes, Hungarian grass, peas, millet, and turnips; but in consequence of the severe drought the results were unsatisfactory. The best yield of cotton did not exceed 363 pounds per acre, while in the previous year it was 900 pounds. Six different fertilizers were used, in equal quantities of each, consisting of superphosphate, Stearns's raw bone superphosphate, blood fertilizer, Cuvir's superphosphate, bromophite, and cotton-seed-oil meal. The ratios of yield per acre were 22, 23, 31, 26, 28, and 26, respectively. Where no fertilizer was used, the yield was 21.

According to the law of the state, one student from every representative district in the several counties shall be selected by a board of examiners, and, besides the tuition, $100 shall be allowed to him from the school-fund of the county to aid in paying his expenses at the university. By this provision of the law 118 students are entitled to enter the university on the following conditions: 1. The candidates must have been pupils in the free schools of the county, and the candidate's home must be in that county where he is examined. 2. They must be at least fourteen years of age, and of good moral character. 3. The $100 will be awarded to the best answerer of questions in a competitive examination upon orthography, reading, penmanship, English grammar, geography, and arithmetic.

The number of students in the university during the collegiate year is 208, and in the college 3. The necessary expenses in this institution for the course of four years to students out of the State who pay tuition need not exceed $200 per year. To those in the State it would be less.

Alcorn University—Agricultural and Mechanical College, near Rodney, Rev. Hyram R. Revels, D. D., president.—The progress of this university has been rapid, and it has a prospect of becoming the leading institution for colored people in that section of the country. It is situated near the Mississippi River, in Claiborne County, four and a half miles northeast of Rodney, and occupies the buildings formerly owned by Oakland College, which was, at the time of purchase, the oldest academic institution in the state, and had been a seat of learning for more than thirty years. The location is high and healthy. The campus on which the buildings are erected is covered with beautiful groves of oaks and commands a charming prospect of the surrounding country, which is clothed with green during the entire year.

The university has been in operation less than three years, having been opened in June, 1872, during which time the debt, amounting to $42,500, incurred by the purchase of Oakland College and other property connected with it, has been paid, and the buildings have been thoroughly repaired. The chapel is a substantial brick edifice, 112 feet long, 65 wide, and three stories high. It contains rooms for recitations, philosophical apparatus, laboratory, cabinet, library, and a hall sufficiently large to seat 900 persons. The literary halls, two in number, are elegant brick structures, each 80 feet long, 50 feet wide, two stories high, and well adapted to literary exercises. The lower room in each of these buildings is furnished with handsome book-cases, and their upper stories are fitted up for society-halls. The boarding-house is a large two-story frame-building, having a basement which contains a dining-hall capable of seating 200 students, a store-room and a pantry. To this building a commodious kitchen, (with a fine cooking-range,) and a capacious wash-room are attached, in connection with the rooms named. The upper rooms of the boarding-house are devoted to the superintendent and his family, and also furnish rooms for the employés of the institution. There are three two-story brick dormitories, each 48 feet long and 45 feet wide, and, taken collectively, of sufficient capacity to accommodate 96 students. They are comparatively new, and have slated roofs and hard-finished ceilings. All the rooms of the dormitories are furnished with new bedsteads and comfortable bedding, and contain grates, tables, wash-stands, and chairs. The president's house is a two-story frame-building with basement, is painted white, and comfortably furnished. There are also several frame-cottages, which are commodious and comfortable, and devoted to the use of the professors and their families.

During the thirty years of its success, Oakland College accumulated a fine library of several thousand choice volumes, and also a very complete collection of specimens in natural history, geology, mineralogy, and botany. When the college was purchased, the library and these valuable collections were left in the possession of the university. Permission has been given to the university to use them, and they are now employed in instructing the students in the different branches of study which they are intended to illustrate. The farm has been increased from 200 acres to 295 and much improved. The land is diversified, is of more than average richness, and well adapted to general cultivation and experimental purposes. There are twenty-five to thirty acres of rich bottom which can be irrigated at all seasons from an elevated lake or pond near by.

The university has three professors, two tutors, two instructors, and one teacher. The number of students in the university, including all the departments, during the present collegiate year, is 170.

MISSOURI.

University of the State of Missouri—Agricultural and Mechanical College, at Columbia, Daniel Read, LL. D., president of the university and college.—George C. Swallow, M. D., LL. D., is dean of this college and professor of agriculture, geology, and botany. The university, including all the departments, has sixteen professors, seven assistants, and seven lecturers. During the year the new chemical laboratory has been put into practical operation. Large additions have been made to the chemical and other apparatus, and the laboratory is now so thoroughly equipped that instruction can be given in the most exact analysis of soils, minerals, waters, ores, and vegetable substances. The apparatus, taken as a whole, for illustrating chemistry, physics, &c., is so extensive and complete that it is hardly surpassed by any collection of the kind in the United States. Among the recent purchases the following may be named: The inductive coil, one of the largest made; Holtz machine, Ritchie's patent; air-pump, Ritchie's patent; magnesian stereopticon, for projecting figures on a screen; several hundred exquisitely painted figures for illustrating physics, anatomy, physiology, mineralogy, &c., to be used with the stereopticon; Browning's large model spectroscope, made on the principle of the Gassiot instrument; spectrum apparatus for the microscope, by Messrs. Browning and Sorby; Browning's large automatic electric lamp and regulator; Browning's new spark-condenser; a complete set of apparatus for illustrating wave-motion; a large number of automatical models of natural size, exhibiting every part of the human body, accurate in form and color, for illustrating anatomy and physiology; and more than fifty pieces of apparatus for illustrating heat, light, and electricity.

Lectures are given each day on the practical application of science to agriculture. Botany is taught by recitations and lectures, illustrated by specimens of living and dried plants, by paintings and drawings which show the form and structure of their various organs. A part of nearly every lecture is devoted to plant-analysis. A monthly paper has been established which is edited and published by the students. It is designed as a record of the affairs of the university, for the publication of literary, educational, and philosophical articles of general interest, and for improvement in literary composition. The library of the university, to which the students of the college have access, now contains 5,000 volumes. The annual appropriation for its increase is $1,200.

There is also a reading room in which a large number of the leading newspapers and the home and foreign periodicals may be found. Of the 330,000 acres of land granted by Congress under the act of July 2, 1862, for the benefit of industrial colleges, only 1,491 acres have been sold. The average price per acre was $1.84. The number of acres remaining unsold is 238,467.

The number of students in the university, including all the departments, during the present year is 553, 69 more than last year.

Missouri School of Mines and Metallurgy, (a department of the preceding university,) at Rolla, Daniel Read, LL. D., president of the school.—Charles P. Williams, Ph. D., is director of this school and professor of analytical chemistry and metallurgy. It has five professors and two assistants. Some changes have been made in the faculty during the year. C. Santis has been elected professor of pure mathematics, and two assistants have been employed, Peter E. Blow in analytical chemistry, and A. W. Hare in mathematics. Surveying and other apparatus has been purchased to the amount of $2,500, and about $500 have been expended for additions to the library. The apparatus is very complete, and, with the library, is valued at $16,000. It is the intention of the curators of the school to add a second year to the course of study of the preparatory department, for the convenience of those not desirous of taking a full professional course. An evening course of lectures is also delivered on anatomy, physiology, and hygiene during the winter semester, and is open to all students. These lectures are fully illustrated by preparations, diagrams, and other apparatus. In the department of metallurgy full cognizance is taken of the peculiar economic conditions surrounding metallurgical industry in this country, and special reference is also had to the staple metallic products of Missouri, as iron, lead, and zinc. Studies are made of local iron-establishments, and excursions are undertaken to other iron-works, as well as to those at which lead and zinc ores are practically treated.

The fees for instruction are $10 as an annual entrance fee, and an assessment of $5 per semester for incidentals and use of library; also $5 before graduation for a diploma, and $1 for a certificate of proficiency. Good board can be obtained for $3.50 to $4 per week. The number of students in attendance during the present collegiate year is 107, 32 more than last year.

NEBRASKA.

University of Nebraska—College of Agriculture, at Lincoln, Allen R. Benton, LL. D., chancellor.—None of the land granted by Congress under the act of July 2, 1862, has been sold, but the subject of sale is under consideration, and measures will probably be soon taken to dispose of a part of it, and to lease other portions to private individuals for a term of years. During the year a new farm of 320 acres has been purchased for $17,500. The old one, which was found to be unsuitable for experimental purposes, will be sold, and the money used in payment of the present purchase. Important improvements have been made on the farm during the year, and new farm-implements and choice breeds of stock purchased, the whole amounting to $6,800. Fifty-three acres have been under cultivation with tilled crops, 20 acres of which were in wheat, 24 in corn, 6 in oats, and 3 in other crops. Six acres, which were sown with Mediterranean wheat, yielded 101 bushels of superior quality, or about 17 bushels per acre. It sold at an average price of 15 cents above that of common wheat, and the flour was not inferior to winter-wheat. It is the intention of the college to cultivate only the best varieties of

wheat and other grains, and to sell them to the farmers of the State for seed, thus affording a profit to the college and at the same time aiding the farmers. Osborn's seed-cleaner is now used on the experimental farm. It is said to do excellent work, and to be as nearly perfect in its kind as anything can well be. The leading topics which will be made subjects for future experiments on the farm are, the best method of cultivating the ordinary grains and testing new varieties of the same, the determination of the fitness of new kinds of fruits and vegetables for the soil and climate of the State, the cultivation of the tame grasses, and the breeding of stock, especially hogs and cattle.

During the college-vacation in the winter the professor of agriculture held farmers' institutes in four counties of the state. They were well attended and gave excellent satisfaction. The day-sessions were occupied in discussions on practical farm-work, and the evenings in reading essays and delivering lectures. The lectures and essays were contributed by the chancellor and professors of the university, and other distinguished agriculturists and scholars of the State, whose names may be found in the chancellor's report to the board of trustees for 1874. Besides the farmers' institutes, the professor attended six teachers' institutes, and spoke at each of them at least one evening on the claims of agricultural education, and in relation to the work of the college. During the same vacation he was employed three or four weeks as instructor in the teachers' institutes held throughout the State, and used his pen constantly during the year in discussing agricultural topics in the newspapers of the State.

There are three professors and one assistant in the College of Agriculture, and in the university, including all the departments, seven professors and one assistant. The course of study in the college has been changed from four years to three. The number of students in the university during the collegiate year is 100, 12 of whom are in the College of Agriculture. There was a graduating-class of six students, who received the degree of bachelor of science.

NEVADA.

This State has not as yet established an agricultural and mechanical college, nor has any part of the 90,000 acres of land granted by Congress for that purpose, under the act of July 2, 1862, been sold. It is the intention of the State, however, to make this land available, by sale or otherwise, at an early date, for the support of a college such as was contemplated by the National Government in making the endowment. It has established a university called the "State University of Nevada," Congress having granted seventy-two sections or 46,080 acres of land for that purpose. This grant is distinct from that made for the endowment of an agricultural and mechanical college. The university was located in 1873 at Elko, in Elko County, and one department, called the "preparatory department," is now in operation under the direction of Mr. D. R. Sessions as principal, who is the only teacher at present employed. The trustees will open other departments as soon as the means can be furnished, and the agricultural and mechanical college will probably be one of them.

NEW HAMPSHIRE.

Dartmouth College—New Hampshire College of Agriculture and the Mechanic Arts, at Hanover, Rev. Asa D. Smith, D. D., LL. D., president.—The College of Agriculture and the Mechanic Arts has ten professors, two instructors, and one tutor; the parent college, including all

the departments, twenty-six professors, six instructors, two tutors, and one lecturer. The faculty of the former has been increased during the year by the appointment of William Thayer Smith, A. M., instructor in natural history, and Thomas W. D. Worthen, A. B., instructor in mathematics.

Conant Hall has been completed, and the boarding establishment connected with it for the accommodation of the students of the college is in successful operation, furnishing excellent board for 100 to 150 young men at the moderate price of $3.25 per week. A large proportion of the meat, vegetables, and milk used in the establishment is supplied from the farm, and is mostly the result of the labor of the students. The manual-labor system still continues to work with admirable success. The students from the various departments of the college work on the farm, saw wood, cook, wait upon the table, and do all kinds of mechanical work which is furnished them, such as repairing buildings, farm-implements, &c., so eager are they to earn all they can to aid in defraying the expenses of their college course.

The number of students in the College of Agriculture and the Mechanic Arts during the present collegiate year is 33, 11 more than the previous year; in the parent college, including all the departments, 420.

NEW JERSEY.

Rutgers College—Rutgers Scientific School, at New Brunswick, Rev. William H. Campbell, D. D., LL. D., president.—The Scientific School has ten professors, and the college, including all the departments, has thirteen professors and one adjunct professor. Professor Cook has made some interesting analyses of greensands and marls taken from eight different beds in New Jersey, and given their fertilizing and other elements in a tabulated form. They are found to be rich in phosphoric acid and potash, the former ranging from 1.14 to 4.67 per cent., and the latter from 3.65 to 6.46 per cent. They surpass leached ashes in value, which, according to Professor S. W. Johnson's analyses, are worth at most $5.25 per ton as estimated by their chemical elements; while the greensand marls range in value, as computed from their phosphoric acid and potash only, from $3.50 to $8.50 per ton. Six specimens of muck were also analyzed, and "yielded an average of one-fourth per cent. of the elements of ammonia," and these elements would have the value of $7 per ton if they had been in a condition for plant-food; but as they were not, the value of the muck was but small. If composted with barn-yard manure, lime, or ashes the muck may be made by this process equal in value to the same quantity of the best stable-manure. Experiments were made in the culture of two and four one-hundredths acres of Fultz wheat, manured with 800 pounds of Whann's superphosphate, and the yield was 73 bushels, or about 36 bushels per acre. Professor Cook says that the whole matter of soils, their adaptation to particular crops, and the peculiar fertilizers each needs, should be continually studied and improved. Soils on granite, limestone, slate, sandstone and shale, trap, clay, marl, drift, and alluvium differ from one another, and to farm them intelligently and profitably they must be studied in the laboratory and the field. The expense for manures on some of them is much more than on others, while the cost of tillage may be much less.

The number of students in the Scientific School during the present collegiate year is 62, 15 of whom are pursuing agricultural studies. In the university, including all the departments, the number is 188.

NEW YORK.

Cornell University—Colleges of Agriculture and the Mechanic Arts, at Ithaca, Andrew D. White, LL. D., president.—The College of Agriculture and the Sibley College of the Mechanic Arts have fourteen professors, and the university, including all the departments, has thirty professors, nine assistant professors, and ten instructors, making the entire faculty forty-nine. William R. Lazenby, Ag. B., has been appointed instructor in horticulture, and superintendent of the botanical and general garden. A change has been made in the agricultural course of study, by which the French language has been omitted. A tenant-house and tool-building have been built, and the new barn which was erected last year has been completed. The farm has been considerably improved by building new fences, removing stones, and the enrichment of the land by the application of commercial fertilizers, and other manures. Professor I. P. Roberts has conducted important experiments, with his usual care, in the culture of corn, having special reference to the fertilizers used and the number of stalks to be grown in a hill; of potatoes, with different fertilizers; and of oats sown in drills and broadcast. He has also made experiments with seeds received from the Department of Agriculture, consisting of Probestier and Chevalier barley; Early Fellow, Houghton, Potato, and White Schonen oats. An abstract of these experiments, with their results, may be found in this report, in the article entitled "Farm-experiments." Professor G. C. Caldwell has analyzed specimens of Ralston's, Woodford & Chamberlain's, and Phillips's improved phosphate of lime; Fostertown and S. Branch, Creamridge, and Squankum and Freehold marl, and given the quantities of their fertilizing elements.

The number of students in the Colleges of Agriculture and the Mechanic Arts, during the present year, is 66, 17 of whom are pursuing agricultural and 49 mechanical studies. The number in the university, including all the departments, is 521. All the students not pursuing the regular course of civil engineering, give some attention to agricultural and mechanical studies.

NORTH CAROLINA.

University of North Carolina—College of Agriculture and the Mechanic Arts, at Chapel Hill, Rev. Solomon Pool, D. D., president.—Contrary to the expectations of the trustees this university has not resumed its exercises, which have been suspended for the last three years. The College of Agriculture and the Mechanic Arts, therefore, remains in the same condition as at the time of the closing of the university. It appears to be entirely uncertain when the people will be able to receive the important benefits intended to be conferred by Congress on the state in making the liberal endowment of land-scrip for the establishment of the college. The present amount of the invested fund is $125,090. The sum for which the land-scrip was sold is $135,000.

OHIO.

Ohio Agricultural and Mechanical College, at Columbus, Edward Orton, A. M., president.—During the year the faculty of this college has been increased by the addition of Albert H. Tuttle, M. S., professor of zoölogy and comparative anatomy; William Colvin, A. M., professor of political economy; and Thomas Matthew, instructor in free-hand and mechanical

drawing. There are nine professors and one instructor connected with the college. The main college-edifice is now completed, and the exercises in the different branches of study are in full operation. Two boarding-houses have been erected, one about a year ago and the other during the present year. The former is a three-story brick building, which cost $30,000, and is capable of accommodating seventy students. It is heated with furnaces and supplied with gas, bath-rooms, &c. The latter is constructed of the same material, is two stories high, and contains twelve rooms. It is designed as a club boarding-house, and cost $5,000.

The farm has been considerably improved during the year, and the following crops have been raised: One thousand two hundred and seventy-two bushels of corn, 179 of wheat, 166 of oats, 84 of barley, and 100 tons of hay. Twelve steers and the same number of hogs have been fattened and sold. The students of the college have been employed, as far as was practicable, in laboring on the farm and improving the college-grounds, for which they have received $1.50 for a full day's work. The sum paid them during the year for labor is $485.39. It is the intention of the college to carry on farming much more extensively next year than it has during the present. It will be adopted as a rule to give the students all the work they desire to perform, without interfering with their progress in their studies.

The number of students in attendance during the present collegiate year is 50, 40 of whom are pursuing agricultural and mechanical studies.

OREGON.

Corvallis College—State Agricultural College, at Corvallis, B. L. Arnold, A. M., president.—There are four professors and two assistants in Corvallis College, all of whom, except the two assistants, are also employed in the Agricultural College. The parent institution embraces two general departments: 1. A literary department; 2. A scientific department. The literary department comprehends, (1) a school of ancient languages, (2) a school of modern languages, and (3) a school of history and literature. The scientific department comprehends, (1) a school of mathematics, (2) a school of engineering, (3) a school of practical mechanics and technology, (4) a school of physical science, including chemistry, natural philosophy, biology, and agriculture; and (5) a school of moral science. The school of mathematics, the schools of languages, the school of physical science, and the school of moral science are now in active operation, and the other schools will be opened as soon as the funds of the college will admit.

Special attention is given to agricultural chemistry as being the only foundation of scientific agriculture. The student begins with the analysis of soils and rocks, and then proceeds to the analysis of fertilizers and farm-products, such as food, wool, and beverages. The qualitative analysis of the metals, the general methods of preparing soils, the subject of fertilizers and drainage, and the nature and constitution of plants are also studied. Specimens of the soil of the state, called "white soil," have been analyzed by the chemist of the college with special reference to its fitness for wheat-production, to which the State appears to be especially adapted. It is found to contain silica, sulphuric acid, phosphoric acid, potash, soda, lime, oxide of iron, alumina, magnesia, and a trace of magnetic oxide. All the elements of successful culture of wheat are shown to be present in the soil in liberal quantity, except sulphuric acid, which may be easily supplied by the use of gypsum.

An experiment has been made in the culture of wheat on the "white soil" of the college-farm, by using different fertilizers, with the following ratios of yield: Superphosphate yielded 10½; fresh horse-manure, 8; burnt bones, pulverized, 9; spent ashes treated with sulphuric acid, 11; sulphate of lime, 12; fresh ashes treated with sulphuric acid, 11½; air-slaked lime, 8; human urine, 9; spent ashes, 8½; fresh ashes, 9½. The largest yield was from the use of sulphate of lime, (gypsum,) which, according to the analysis of the chemist, was wanting in the soil, thus showing the importance of a thorough knowledge of the elements of the soil cultivated.

The number of students in the parent college, including all the departments, for the present collegiate year is 156; in the Agricultural College, 40. Sixty-four students have been enrolled in the military class, and received a regular drill in military tactics.

PENNSYLVANIA.

Pennsylvania State College, Centre County, Rev. James Calder, D. D., president.—The court of Centre County, at its January term of the present year, changed the name of this institution from the Agricultural College of Pennsylvania to the Pennsylvania State College. This change was made because the former name was not sufficiently comprehensive to express the design of the college, which was, according to the act of Congress granting the endowment, not only to give instruction in agriculture, but also in the mechanic arts, military tactics, and the languages, if desired. The courses of study and the practical working of the institution remain the same as before the change. The college has six professors, one assistant professor, and two instructors. Although there are three courses of study in the college, yet the students in the freshman classes of all these courses are required to study agriculture, and all the students below the junior class are required to practice it.

Three large laboratories, with all the necessary appliances, are provided for students, and a fourth for the use of the professor of chemistry. These rooms will accommodate about eighty students. On entering the laboratory, students first study the simplest principles of analysis, acquire the use of the blow-pipe, and learn to handle apparatus. In the higher classes they make complete analyses of the different materials presented to them, first having to determine the quality of the ingredients, and their respective quantities. To each student is given, as far as practicable, a course of work most applicable to his intended pursuit in life. All the chemical work performed in the laboratory is accompanied by lectures explaining the theory of analysis, reactions involved, &c. To meet the wants of technical students, a series of lectures on technical chemistry has been introduced into the scientific course. Students in this course make extended excursions to manufactories and technical works located in the vicinity of the college, as the Oak Hall woolen factory, Bellefonte water-works, gas-works, glass-works, steam planing-mills, steam flouring-mills, paper-mills, car-works, smelting-furnaces, forges, founderies, steel and wire works, and the Snow-Shoe coal-mines. The geological collection made by Professor Rogers during the geological survey of the state affords rare facilities for acquiring a thorough knowledge of the geology of Pennsylvania. In addition to this, opportunities are offered for studying may specimens *in situ* in the neighboring mountains and valleys.

Various experiments have been made on the experimental farms, which have developed interesting results, but none of them are as yet sufficiently

matured to establish with certainty any new principles. The college garden contains about six acres of excellent land, which has all been subsoiled or trenched, well limed and manured, and is now highly productive. It is well stocked with the best varieties of currants, gooseberries, strawberries, and cherries in great abundance. The apple-orchard contains twelve acres of choice varieties which are just coming into bearing.

The number of students in the college during the present collegiate year is 149, 17 of whom are ladies.

Brown University—Agricultural and Mechanical Department, at Providence, Rev. E. G. Robinson, D. D., LL.D., president.—The Agricultural and Mechanical Department of this university has eleven professors and two instructors; and the university, including all the departments, eleven professors and four instructors. The addition recommended last year by the trustees to be made to Rhode Island Hall is nearly completed, and will largely increase the facilities for college-work. It contains an apparatus-room, work-room, photographing-room, and an experimental laboratory, besides adding largely to the capacity of the museum of natural history. It is substantially built, well lighted, and presents a fine architectural appearance.

The course of study of the Agricultural and Mechanical Department is included in the "courses of instruction for the degree of bachelor of philosophy," and occupies three years. Agriculture is also taught by lectures, given by the professor of agriculture, J. W. P. Jenks, A. M. Professor Jenks has devoted a large portion of his time during the year to classifying and labeling the numerous specimens collected for the museum of natural history. Every department has been enriched, either by contributions or exchanges, particularly the conchological, entomological, mineralogical, geological, botanical, and numismatical. The additions in conchology number 2,588 specimens; in entomology, 207, illustrating the insects of Rhode Island, besides 51 family types of coleoptera; in mineralogy, 240; in geology, 403; in botany, 200; in numismatology, 174, with some hundreds of miscellaneous specimens. The insect-cases have been duplicated. Including the assistance rendered by students and others, more than a year's labor of one individual has been bestowed on the museum the present year.

The agricultural state-scholarships now number thirty-five, and the beneficiaries have been duly assigned by the committee authorized to make the appointments. The annual income from each of these scholarships is $100. According to a statute passed by the general assembly of Rhode Island March 7, 1873, the names of all the candidates for state scholarships in Brown University shall be "proposed" by "the senators and representatives of the several cities and towns in general committee," and the beneficiaries shall consist of those "who shall not have the means of procuring an education for themselves." According to the same statute, the governor, the secretary of state, and the president of the university "shall select from the persons so propounded or nominated in grand committee such of them as are eligible candidates for existing vacancies." There are about one hundred scholarships in the university, including those of the Agricultural and Mechanical Department. They vary in their value and the income yielded. The sum fixed for each, except the state scholarships, is $1,000, and the income $60, although some of them are much larger and yield more. Some individuals have given $4,000 and $5,000 respectively. Mr. John Carter Brown, of Providence, son of Mr. Nicholas Brown, from whom the university derived its name, bequeathed at his death, which occurred

during the present year, $50,000, to aid in erecting a fire-proof building for the university library, and also gave a lot on which to build the same. He had previously given $20,000 for the same purpose, so that the university has now $70,000 secured for the object specified. The students of the Agricultural and Mechanical Department will share the benefit of these donations, as they use the library in common with the other students of the university. It now contains more than 40,000 choice and carefully-selected volumes in the different departments of literature and science.

The expenses per year at this institution, exclusive of board, are $102. Board may be obtained for $3.25 to $5 per week. The number of students in the Agricultural and Mechanical Department during the present collegiate year is 35, all of whom are pursuing agricultural or mechanical studies. The number in the university, including all the departments, is 253.

SOUTH CAROLINA.

Claflin University—South Carolina Agricultural College and Mechanics Institute, at Orangeburg, Rev. A. Webster, D. D., president.—No full report of this college for the present year has been received by the Department. We have only been able to learn that the state bonds in which the proceeds from the sale of the congressional land-scrip were invested have not yet been transferred to the trustees of the college, and that only the sum of $6,836 of the interest due on them has been paid.

TENNESSEE.

East Tennessee University—Tennessee Agricultural College, at Knoxville, Rev. Thomas W. Humes, S. T. D., president.—The Agricultural College has nine professors and three instructors, and the university, including all the departments, nine professors and nine instructors. During the present year the courses of study in the college have been changed, for the purpose of making them alike for both agricultural and mechanical students in the freshmen and sophomore years. The law of the State has been so amended that each county is no longer entitled to send three students to college without charge for tuition; but each State senator may send two, and each state representative three. Forty-two counties of the state are now represented in the collegiate department of the university by 213 students thus appointed. The students are organized into a battalion, and are required to perform military drill daily, under the direction of the professor of military tactics. A uniform of fixed pattern is worn. Two hundred cadet-muskets, with accouterments, and two field-pieces, with equipments, have been furnished by the United States Government to the college for the use of students.

A new laboratory building, connected with the college edifice, has been erected. It is 51 feet long and 36 wide, and contains a chemical laboratory-room, 25 by 36 feet, a lecture-room 14 by 16 feet, a balance-room, and a store-room, each of which is 12 by 15 feet. There are also several smaller rooms for dormitories, which will accommodate forty to fifty students. It is well equipped with apparatus of the best quality, and has a large supply of chemical re-agents. Among the apparatus are two analytical balances, a Hofman combustible-furnace for organic analysis, graduated jars, and all the other apparatus found in the best laboratories in the country. It will be increased yearly by an appropriation made for the purpose. The building is furnished with a liberal

supply of water, and will be well lighted with gas. The college library is open to all students free of charge. The cabinets of geology, mineralogy, and zoölogy are constantly increasing. A collection of 700 models of machinery has been recently received from the Government Patent Office, and is now open to the inspection of students. The extensive private collections of Professor Bradley are also freely devoted to the use of the college.

All able-bodied students are now required to perform a small amount of labor on the farm, and those who wish to do more than the amount required are, to a limited extent, furnished by the college with work, for which they are paid a price varying with the kind and amount performed.

The number of students in the university, including all the departments, during the present collegiate year, is 317, and in the college 85, all of whom are pursuing agricultural or mechanical studies.

TEXAS.

Agricultural and Mechanical College of Texas, at Bryan.—The legislature of the state, at its last session, made an appropriation for completing the college building, and erecting a boarding-hall, professors' residences, and a barn; and also for grading the college grounds and ornamenting them with trees and shrubbery. About $100,000 have already been expended in erecting the college building, which is now nearly completed. It is a large and elegant brick edifice, and well adapted to the purposes for which it is designed. A board of directors has been chosen, and is now engaged in preparing a plan for the organization and administration of the college. The professors will be appointed immediately, and it is expected that the college will be opened and in full operation by the 1st of September, 1875.

VERMONT.

University of Vermont and State Agricultural College, at Burlington, Matthew H. Buckham, A. M., president.—This institution has eighteen professors and three assistant professors; seven of these professors are employed in the State Agricultural College, which is a department of the institution. Arrangements have been made for a winter course of lectures for farmers, to commence February 2, 1875, and to continue four weeks. The lectures will be as simple and practical as the subject will admit, and be illustrated by experiments, models, specimens, and the blackboard. Their object will be, not to exhaust the subjects of which they treat, but to stimulate and direct private study, and prepare the way for more intelligent work on the farm. They will embrace the subject of rocks and soils, fertilizers, and exhaustion of soils, fallowing, rotation, the principles of fertilization, commercial fertilizers, nutrition of plants and animals—twenty lectures; grasses and forage-plants, forests and forest-trees, formation and use of peat and muck, birds and insects useful and hurtful, farm-animals, and principles of stock-breeding—twenty lectures; fruits and fruit-culture, especially as adapted to the climate of Vermont, hybridization, budding, and grafting—ten lectures; drainage, road-making, and bridge-building—five lectures; reading, writing, and speaking—five lectures; farm-accounts and rural law. The fee for the course is $10; board, including fuel and lights, is $5 per week.

It is in contemplation by the trustees of the institution to appoint a professor for the Agricultural College at the earliest opportunity, who

may be able to devote his whole time to instruction and investigation in this department. The department of chemistry is thoroughly equipped for work in all the branches relating to this subject. The laboratory is ample, and is claimed to be unsurpassed in completeness by any in the United States. The same facilities are offered for pursuing chemical studies as at Harvard or Yale. The full course in chemistry occupies four years, embracing all the kindred studies relating to agriculture and other subjects, and combining a large amount of laboratory practice with study of text-books. The college-grounds have been thoroughly underdrained, graded, and planted with trees, the level portion of which makes a convenient and beautiful parade-ground. Extensive improvements of the college-park are in progress, and a handsome fountain, the gift of Mr. John P. Howard, will soon be erected. One thousand three hundred and fifty-three bound books have been added to the library, which now contains 15,524 volumes, exclusive of pamphlets. The collections of the museum have been increased by the addition of valuable sets of rocks and fossils from the Yellowstone region, given by the Smithsonian Institution; and many interesting specimens have also been presented by the students and friends of the university. The income of the University and State Agricultural College during the present year is $19,342.67, $8,130 of which were derived from the Agricultural College fund, $5,002.15 from rents, $2,504.01 from other funds, and $3,706.51 from tuition of students.

All male students are required to take part in military drill about two hours weekly during the summer and fall terms, under a military professor detailed by the War Department of the United States for that purpose. Military instruction is also given during the winter by lectures and in other ways. The United States Government has loaned to the college one hundred stand of Springfield breech-loading muskets, and all the necessary accouterments for officers. A simple and cheap uniform, consisting of a blouse, cap, and gloves, and costing about $5, is worn during drill. The number of students in the university and college during the collegiate year is 138, 25 of whom pursue agricultural and mechanical studies.

VIRGINIA.

Virginia Agricultural and Mechanical College, at Blacksburgh, Charles L. C. Minor, M. A., president.—During the year the trustees of the college have built a work-shop 60 feet long, 30 feet wide, and two stories high; two one-story boarding-houses for students, one 16 by 20 feet, and the other 16 by 24 feet, each with a dining-hall, kitchen, and store-room; and a dormitory-building 16 by 16 feet and one story high. They have also purchased, with money contributed by Montgomery County, a lot of land with a cheap house upon it, which one of the professors has fitted up into a modest residence for himself and family; also two other lots with houses which, although in poor condition, will be used for boarding-houses and dormitories till replaced by better structures. From the same county-fund 80 acres of good land adjoining the present farm have been purchased, increasing its size to 324 acres. The general assembly of the state, at its last session, appropriated $45,000 for buildings, and contracts have just been closed for the immediate construction of two large college edifices and two professors' houses. One thousand three hundred and fifty dollars have also been expended for the purchase of books and apparatus, and $880 for equipment of the farm.

Two varieties of wheat, the Fultz and the White Blue-stem, were cul-

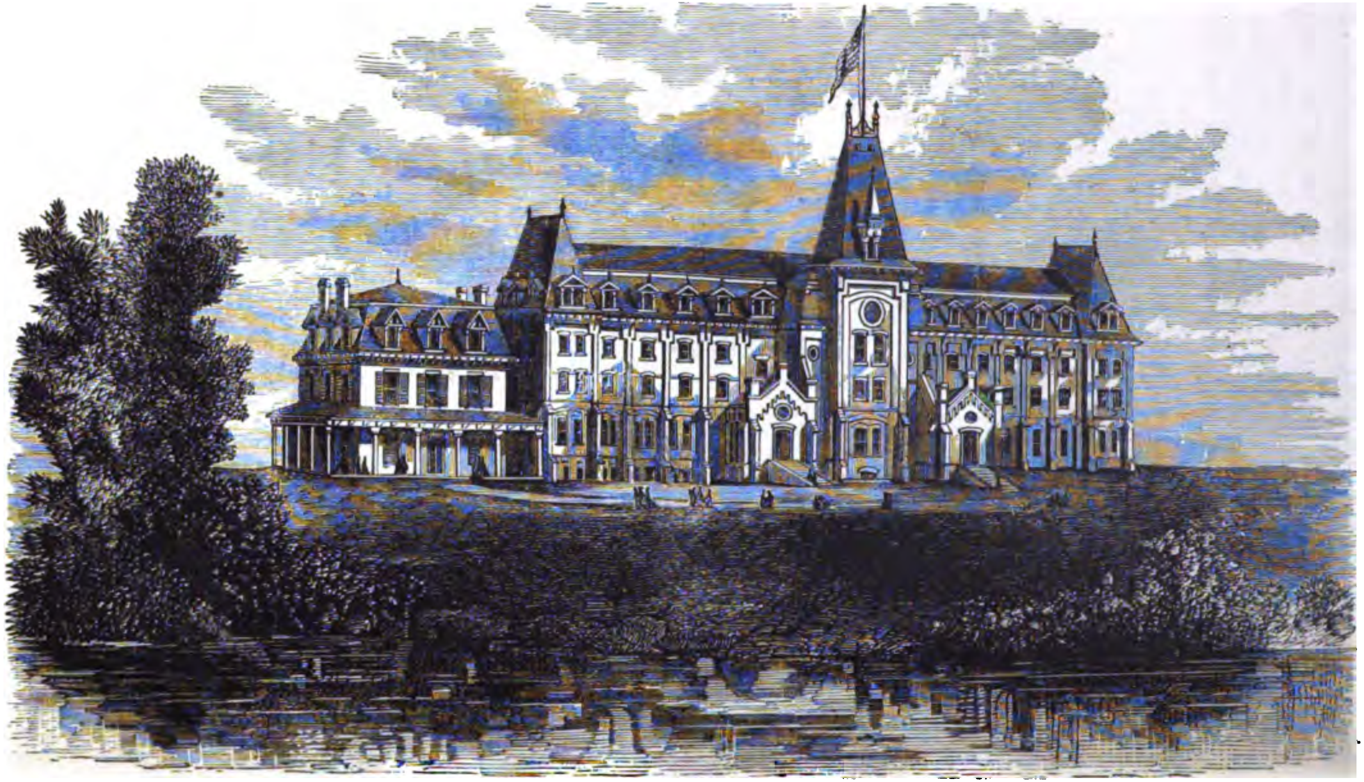
tivated on the farm, and yielded more than 20 bushels of superb quality of wheat per acre. The fertilizers employed were the Southern Fertilizing Company's, the Patapsco Guano, and the Farmers' Excelsior. Two hundred pounds per acre of these fertilizers were used on different portions of the field, and experiments showed that the yield of wheat was more than doubled by their use; also that, for the varieties of wheat named and the soil employed, one bushel of seed per acre is the best quantity. One-half bushel yielded less than one bushel, and one bushel and a half less than either, and two bushels least of all. The corn was fertilized with barn-yard manure, and yielded sixty bushels per acre. The cattle which were grazed on the farm were sold at the highest market-prices, and the profit realized on the sales was within a fraction of 100 per cent. A considerable income was also derived from rental of pasturage of stock for other persons.

No student is exempt, except for physical disability, from a regular turn at manual labor. Labor intended for purposes of instruction is not paid for, but most of the other work is done voluntarily for pay. All the current repairs are made by the students, and too small houses are now in course of construction by them. More than half the work done on the farm during the crop-season, besides that performed by the regular unpaid details, has been done by students, and is paid for at a price per day or hour, varying with the strength and industry of the student, according to the discretion of the farm manager. This money goes to the neediest as well as to the most energetic young men, meeting in a few instances all their expenses, and in many cases giving them assistance without which they could not remain at college. Students from the cities, whose circumstances have removed them from any experience in manual labor, whose means are sufficient to relieve them from the necessity of it, not unfrequently seek employment on the farm to make money, so entirely has the public opinion of the college overcome any false shame about hand-work. The cost to the student for living at the college varies from $5.50 per month, room-rent free, to $15 per month for furnished room and table-board.

The college has 6 professors and a farm manager. The number of students in attendance for the collegiate year is 197, an increase of 65 over the preceding year.

Hampton Normal and Agricultural Institute, at Hampton, General Samuel C. Armstrong, president.—There are in all the departments of this institute 17 teachers, 6 gentlemen and 11 ladies. "Virginia Hall," which is designed for young women, is nearly completed. The material of the building is red brick, the color being relieved by lines and cappings of black. It measures 190 feet in front by 40 in width, and has a wing running 100 feet in the rear. It contains a chapel with a capacity for seating 400 persons, an industrial room for the manufacture of clothing and for instruction in sewing in all its branches, a dining-hall capable of accommodating 275 boarders, a large laundry and kitchen, accommodations for 12 teachers, sleeping-rooms for 150 girls, a printing-office, and a workshop. An engraving of the edifice may be seen on the opposite page. A large portion of the money employed in erecting the building has been furnished by the "Hampton Students," who collected it by giving musical concerts in different sections of the country.

During the year 50 acres have been cultivated with corn, 20 with wheat, 25 with oats, 12 with clover, 7 with early potatoes, 3½ with sweet potatoes, 3 with asparagus, 5 with corn-fodder, 4 with late Irish potatoes, and 1 with carrots. The number of trees in some of the orchards has been



HAMPTON (VIRGINIA) NORMAL AND AGRICULTURAL INSTITUTE.

considerably increased since the last year. The peach-orchard contains 800 trees, the pear 700, the apple 500, the cherry 400, the quince 150, the plum 50, and the vineyard 150 grape-vines. Two crops of corn-fodder are raised each year, and 30 tons of clover have been cut. It has been found profitable to raise more feed and to keep more stock, thus increasing the quantity of manure every year. Owing to adulteration, the use of guano will be discontinued, and more reliance placed on home-made fertilizers. Bone-dust has been used with profit. The coarse fodder raised on the farm has been cut by a machine, and steamed in a box containing 342 cubic feet, and lined with galvanized cast iron, having a perforated false bottom. Much of the fodder that would otherwise have been wasted was made palatable and healthful, as the cattle never thrived better. The supply of fodder was virtually increased 30 per cent. by this process. The present farm, which contains 125 acres, is not of sufficient size for conducting the operations of the school profitably. The president recommends to the trustees to purchase an additional one of 300 or 400 acres, at an expense of not more than $10,000, and to expend $10,000 for machinery most suitable for the purposes of instruction and production. He advises also to expend $10,000 in erecting dormitories for young men, of which there is at present a great deficiency, many students being obliged to occupy recitation-rooms and other temporary buildings.

The annual expense of the institute for the support of seventeen teachers and officers and 245 students, is about $40,000, or $163 for each pupil. This sum includes the whole outlay for board and living expenses, besides salaries, apparatus, &c. The most of this money has been derived from donations secured by the president and the financial secretary in the Northern States. Virginia sends 144 students to the institute, who are all allowed to work out half of their personal expenses, and all are educated without charge for tuition. The amount paid for students' labor during the year is $6,750.33, for which they received 5 to 10 cents per hour. The number of students attending the institute during the present collegiate year is 245, 50 of whom pursue agricultural studies and 25 mechanical. The number of females in the institute is 82.

WEST VIRGINIA.

West Virginia University—Department of Agriculture, at Morgantown, Rev. Alexander Martin, D. D., president.—This university has eight professors, four assistants, and two lecturers. A part of the professors and assistants give instruction in agriculture and military tactics. Professor S. G. Stevens, A. M., has vacated the chair of astronomy and physics, and the work of this professorship has been assigned to the president of the university. New hall represented in the report of this Department for 1873 as being in course of construction is still unfinished, the center building of which will not be completed until the summer of 1875. It will contain the laboratories, library, museum, and apparatus. From estimates recently made it is ascertained that the cost of the center building will be $63,000.

The number of students in the university during the present collegiate year is 138, 31 of whom receive instruction in agricultural studies.

WISCONSIN.

University of Wisconsin—College of Arts, at Madison, John Bascom, LL. D., president.—The College of Arts, which embraces the Agricultural

and Mechanical College, has nine professors and five instructors; the university, including all the departments, sixteen professors, six instructors, and five teachers. Several changes have been made in the faculty of the university during the year. John Bascom, LL.D., has been appointed president in place of Rev. J. H. Twombly, D. D., resigned, and John M. Olin, A. B., has been elected instructor in rhetoric and oratory; Jerome H. Salisbury, A. M., instructor in Greek and Latin; Joseph C. Fuller, A. B., in English, and James B. Stewart in drawing. Some changes have also been made in the law and other departments. The post-graduate course forms an important feature in this university. Bachelors of art, science, and philosophy are admitted to this course, and are required to devote two years to study under the direction of the president and faculty, and to pass a satisfactory examination before a board of examiners appointed by the regents. The studies pursued are elective, but must be selected from at least two sections, and those of one of the sections must be continued through the whole course. The object of this course is to secure a higher grade of scholarship in literature and science than it is possible to attain in pursuing the courses of study as at present arranged in most of our colleges. An appropriate degree is given to the students when the course is completed. Ladies pursue any course or elective study in the university, and the same degree is conferred upon them as upon the gentlemen for the satisfactory completion of any course of study. To some of the board of visitors the presence of young ladies in the same classes with the gentlemen was a novelty, and therefore incited them to a careful scrutiny into the practical working of the co-educational idea. They were especially observant on this point, that they might get light on a subject which provokes so much antagonistic discussion. In their report on the examination of the classes of the university, they say that "they took particular notice of the recitations of the young ladies in Latin, Greek, logic, and mathematics, that they might see whether there was any less vigor of thought, less mental grasp, less mastery of those subjects of which gentlemen have heretofore claimed a monopoly, and in justice to the ladies they must here bear testimony to the fact that no such discovery was made, but rather the discovery of their ability to prosecute the same course of study as the young men, and with equal prospect of benefit, success, and honor."

Experiments have been made on the university farm by Professor W. W. Daniells with winter-wheat, spring-wheat, barley, oats, corn, potatoes, and in the improvement of soils by mechanical means. Extensive meteorological records of temperature, height of barometer, pressure of vapor, humidity of the atmosphere, amount of rain and snow, force and duration of winds, kinds of clouds, &c., have also been made by him, all of which, and the experiments made on the farm, may be found in the annual report of the university for 1874. There are 900 grape-vines of the Concord variety on the university farm, which are in the third year of bearing, and yielded the present year 4,500 pounds of grapes, in some cases 28 pounds being gathered from a single vine. The apple-orchard contains 500 trees of a few standard varieties; but few have borne fruit.

Of the land granted by Congress under the act of July 2, 1862, 2,951 acres have been sold during the present year at $1.25 per acre. The number of acres remaining unsold is 53,373. These lands are sold at a uniform price of $1.25 per acre, 25 per cent. of the purchase-money being required to be paid down in cash, and the balance in ten years, with interest at 7 per cent. paid annually in advance. A considerable portion

of these lands lie within the limits of the land-grants of the Wisconsin Central and Saint Croix Railroads, and are rapidly appreciating in value. They are now in the market at minimum prices, but it is expected that the prices will soon be raised. The productive agricultural college fund now amounts to $236,134.07, having been increased $10,824.34 during the present year.

Through the liberality of the State, one fine edifice, the Female College, has been erected, but still more accommodations are needed. The board of regents say that the utter inadequacy of the present buildings to accommodate the classes, the need of more laboratory room, the discomfort of teachers and scholars, the failure to reach the best results because of the contracted quarters, and the indispensable necessity to accommodate the rapidly increasing number of students demand that a new building should be built as soon as possible. An earnest appeal will, therefore, be made immediately to the State legislature for the necessary appropriation to construct the building required. The regents are resolved to make the university an institution of the highest order, and the just pride of every citizen of the State. In the management of the university, no personal considerations, or political or sectarian faith will be questions of regard in the appointment of professors or other officers, as it is believed that only by this course can a broad career and high character be maintained for the university.

The number of students in the College of Agriculture and Mechanic Arts during the present collegiate year is 36; in the university, including all the departments, 411.

Statistics for 1874 of the industrial institutions of the United States which have

Number of States having industrial institutions.	Location of the institution. State.	Location of the institution. Town.	Number of industrial institutions.	Name of the institution.
1	Alabama	Auburn	1	Agricultural and Mechanical College of Alabama
2	Arkansas	Fayettville	2	Arkansas Industrial University
3	California	Berkeley	3	University of California—College of Science and the Arts
4	Connecticut	New Haven	4	Yale College—Sheffield Scientific School
5	Delaware	Newark	5	Delaware College
6	Florida		6	Florida State Agricultural College
7	Georgia	Athens; Dahlonega	7	University of Georgia. { Georgia State College of Agriculture and the Mechanic Arts. North Georgia Agricultural College. }
8	Illinois	Urbana	8	Illinois Industrial University
9	Indiana	La Fayette	9	Purdue University—Indiana Agricultural College
10	Iowa	Ames	10	Iowa State Agricultural College
11	Kansas	Manhattan	11	Kansas State Agricultural College
12	Kentucky	Lexington	12	Kentucky University—Agricultural and Mechanical College.
13	Louisiana	New Orleans	13	Louisiana State Agricultural and Mechanical College
14	Maine	Orono	14	Maine State College of Agriculture and the Mechanic Arts
15	Maryland	(near) Hyattsville	15	Maryland Agricultural College
16	Massachusetts	Boston	16	Massachusetts Institute of Technology
		Amherst	17	Massachusetts Agricultural College
17	Michigan	Lansing	18	Michigan State Agricultural College
18	Minnesota	Minneapolis	19	University of Minnesota { College of Agriculture. College of the Mechanic Arts. }
19	Mississippi	Oxford	20	University of Mississippi—College of Agriculture and the Mechanic Arts
		Rodney	21	Alcorn University—Agricultural and Mechanical College
20	Missouri	Columbia; Rolla	22	University of Missouri { Agricultural and Mechanical College. School of Mines and Metallurgy. }
21	Nebraska	Lincoln	23	University of Nebraska—College of Agriculture
	Nevada			(No industrial institution established in the State.)
22	New Hampshire	Hanover	24	Darmouth College—New Hampshire College of Agriculture and the Mechanic Arts.
23	New Jersey	New Brunswick	25	Rutgers College—Scientific School
24	New York	Ithaca	26	Cornell University { College of Agriculture. Sibley College of the Mechanic Arts }
25	North Carolina	Chapel Hill	27 28	University of North Carolina—College of Agriculture and the Mechanic Arts.
26	Ohio	Columbus	29	Ohio Agricultural and Mechanical College
27	Oregon	Corvallis	30	Corvallis College—State Agricultural College of Oregon
28	Pennsylvania	Centre County	31	Pennsylvania State College of Agriculture
29	Rhode Island	Providence	32	Brown University—Agricultural and Mechanical Department.
30	South Carolina	Orangeburgh	33	Claflin University—South Carolina Agricultural College and Mechanics' Institute.
31	Tennessee	Knoxville	34	East Tennessee University—Tennessee Agricultural College.
32	Texas	Bryan	35	Agricultural and Mechanical College of Texas
33	Vermont	Burlington	36	University of Vermont and State Agricultural College
34	Virginia	Blacksburgh		Virginia Agricultural and Mechanical College
		Hampton	37	Hampton Normal and Agricultural Institute
35	West Virginia	Morgantown	38	West Virginia University—Agricultural Department
36	Wisconsin	Madison	39	University of Wisconsin—College of Arts
	Total			

received the national endowment of land-scrip under the act of July 2, 1862.

Name of the president of the agricultural and mechanical college and of the university.	Number of professors and assistants in the agricultural and mechanical college for the collegiate year.	Number of students in the agricultural and mechanical college for the collegiate year.	Number of students in the agricultural and mechanical college pursuing agricultural or mechanical studies.	Number of professors and assistants in the university, including all the departments, for the collegiate year.	Number of students in the university, including all the departments, for the collegiate year.	Number of acres sold, during the year, of the scrip or land granted by Congress, July 2, 1862.	Average price per acre of the scrip or land sold during the year.	Number of acres unsold of the scrip or land granted by Congress July 2, 1862.
Rev. I. T. Tichenor, D. D	9	108	83	......	......	(b)	......	......
Albert W. Bishop, A. M	5	16	16	10	272	......	......	......
Daniel C. Gilman, A. M	27	94	94	36	228	......	......	......
Rev. Noah Porter, D. D., LL. D	31	248	248	87	1,031	......	......	......
William H. Purnell, LL. D	9	52	8	......	......	......	......	......
Hon. Jonathan C. Gibbs, president of directors.	(a)	......	......	......	......	......	......	......
Rev. A. A. Lipscomb, D. D., LL. D., chancellor.	11	132	132	23	428	......	......	......
	7	162	25					
John M. Gregory, LL. D., regent	28	150	150	28	406	(c)	......	25,440
A. C. Shortridge	6	56	56	6	56	......	......	......
A. S. Welch, LL. D	17	295	295	......	......	1,000	$2 78	198,262
John A. Anderson	14	183	183	......	......	1,785	6 93	35,040
John B. Bowman, LL. D., regent	8	180	44	34	406	......	......	......
Maj. J. L. Cross	5	60	......	......	......	......	......	......
Rev. Charles F. Allen, D. D	8	121	121	......	......	......	......	......
Gen. Samuel Jones	7	91	47	......	......	......	......	......
John D. Runkle, Ph. D., LL. D	34	303	303	......	......	......	......	......
William S. Clark, Ph. D., LL. D	11	117	117	......	......	......	......	......
T. C. Abbott, LL. D	12	121	121	......	......	1,879	3 92	169,195
William W. Folwell, A. M	14	4	4	14	287	4,962	5 78	59,957
Gen. Alexander P. Stewart, chancellor.	7	3	3	10	208	......	......	......
Rev. Hyram R. Revels, D. D	5	......	......	8	170	......	......	......
Daniel Read, LL. D	11	......	......	30	553	(c)	......	328,467
	7	107	107				......	
Allen R. Benton, LL. D, chancellor	4	12	12	8	100	(d)	......	90,000
......	......	......	......	......	......	(d)	......	90,000
Rev. Asa D. Smith, D. D., LL. D	13	33	33	35	420	......	......	......
Rev. William H. Campbell, D. D., LL. D	10	62	62	14	188	......	......	......
Andrew D. White, LL. D	7	17	17	49	521	(e)	......	......
	7	49	49					
Rev. Solomon Pool, D. D	(a)	......	......	......	......	......	......	......
Edward Orton, A. M	10	50	40	......	......	......	......	......
B. L. Arnold, A. M	4	40	40	6	156	(d)	......	90,000
Rev. James Calder, D. D	9	149	149	......	......	......	......	......
Rev. E. G. Robinson, D. D., LL. D	13	35	35	15	253	......	......	......
Rev. A. Webster, D. D	......	......	......	......	......	......	......	......
Rev. Thomas W. Humes, S. T. D	12	85	85	18	317	......	......	......
......	(a)	......	......	......	......	......	......	......
Matthew H. Buckham, A. M	7	25	25	21	138	......	......	......
Charles L. C. Minor, A. M	7	197		......	......	......	......	......
Gen. Samuel C. Armstrong	17	245	75	......	......	......	......	......
Rev. Alexander Martin, D. D	8	31	31	14	138	......	......	......
John Bascom, LL. D	14	36	36	27	411	2,951	1 25	53,373
......	435	3,669	2,846	493	6,687	12,577	4 36	1,049,734

(a) This college has not been opened to students. (b) The States having blanks against them in this column have sold all their scrip or land. (c) This State has sold no scrip or land during the present year. (d) This State has sold none of the scrip or land granted by Congress July 2, 1862. (e) The scrip or land sold by this university during the year has not been reported.

IRRIGATION IN CALIFORNIA.

Under an act of Congress, approved March 3, 1873, a commission was organized for an examination of the San Joaquin, Tulare, and Sacramento Valleys of California, with reference to the construction of a system of irrigation. The commission consisted of Lieut. Col. B. S. Alexander and Maj. George Mendell, of the United States Engineer Corps, and Professor George Davidson, of the Coast Survey. These gentlemen immediately proceeded to examine the topography of these valleys, which, together, constitute what is called the "Great Valley of California." The report of their reconnoissance presents a variety of interesting points, some of which are new to the general public. They first argue the necessity of a systematic irrigation of this region from general facts and considerations, most of which have, for years, been well understood by the people of California.

The climatic conditions and orographical configuration of the Pacific coast region, especially as affecting rain-fall, continue to render cultivated crops uncertain in all the territory south of latitude 42. The two seasons, wet and dry, instead of the four seasons into which the year naturally divides itself in the Atlantic States and in the Mississippi Valley, subject the culture of the soil to novel conditions, unsettling old traditions, and defying some of the most tenaciously-held lessons of experience in the older parts of the country. The supply of rain in California is much smaller than in the Atlantic States, and is subject to singular laws of distribution. At San Diego, on the Pacific coast, near the Mexican boundary, the annual rain-fall during twenty-three years averaged only 9.2 inches. In the southeast corner of the State is the great California desert, a broad waste of land, in which large stores of fertilizing principles are kept latent through lack of rain, only occasional showers ever visiting the district. At San Francisco, half way up the coast, a little south of the thirty-eighth parallel, the average of nineteen years was about 23 inches. At Port Orford, Oregon, a little north of the California frontier, the annual average rain-fall during four years was 71.6 inches. These facts show a rapidly-accumulating precipitation of atmospheric moisture along the coast from south to north. The arrangement of the seasons in the northern latitudes approaches more nearly that of the Atlantic coast. These features of the Pacific coast climate result, primarily, from the movement of oceanic currents, affected by the immense breadth and peculiar conformation of the Pacific basin. They show also a powerful modifying influence from the orographical features of the coast region.

The Great Valley of California lies between two ranges of mountains, whose trend is nearly parallel to the coast line. Of these the Coast Range, so called on account of its proximity to the sea, maintains an average elevation of over 2,000 feet above sea-level, reaching a maximum of 6,200 feet a few miles south of Monterey. The southerly winter storms deposit about two and a half times as much rain-water upon the seaward flank of this range as upon the eastern flank, within the valley. San Francisco, located in a gap in this chain, averages but 23 inches of rainfall per annum, while at Pillarcito's dam, but fourteen miles distant, the avarage of nine years was 58 inches. On the east side of the valley, the Sierra Nevada, averaging 9,600 feet of elevation of sea-level and sending many lofty peaks far above the snow-line, arrests the passage of most of the rain-clouds to the interior. Its deposits of snow are es

pecially heavy, reaching sometimes a depth of 60 or 70 feet, with an average of 14 feet during the winter. Here is the great store-house of moisture for the eastern side of the valley. If warm winter rains melt the snow prematurely, the result is heavy flooding of all the streams. In ordinary seasons it awaits the action of warm sunshine in June, giving a very opportune supply of water for irrigation at an advanced stage of vegetation. The Coast Range crowds into the Sierra Nevada at the head of the Sacramento Valley, in latitude 41°. Here the clouds are banked up heavily, and deposit a quantity of moisture from four to ten times greater than in the region of Kern Lake, near the south end of the Great Valley. The whole region is also subject to local variations. For instance, the Kern Lake region enjoys an average annual rain-fall only half as great as in the vicinity of Bakersfield, but a few miles distant.

The wide range of variation in rainfall is illustrated by the following facts derived from authoritative and scientific observations at different points. At Fort Reading the range of three years was from 15.9 inches to 37.4 inches; at Sacramento the range of seventeen years was from 11.2 inches to 27.5 inches; at Millerton, six years, from 9.7 inches to 49.3 inches; at Stockton, three years, from 11.6 inches to 20.3 inches; at Fort Tejon, five yeyrs, 9.8 inches to 34.2 inches; at Monterey, five years, from 8.2 inches to 21.6 inches; at San Diego, twelve years, 6.9 inches to 13.4 inches; at Benicia, twelve years, 11.8 inches to 20 inches. These observations show the rain-fall of calendar years; the following are reckoned by wet seasons. Clear Lake, 1,300 feet elevation, six years, 16.2 inches to 66.7 inches; Visalia, three years, 6.7 inches to 10.3 inches; San Francisco, twenty-two years, 7 inches to 49.3 inches; Pillarcitos, nine years, 39 inches to 82 inches; Sacramento, twenty-four years, 4.7 inches to 36.4 inches; San Diego twenty-two, years, 4.5 inches to 14.8 inches.

The minima of precipitation in the above cases indicate years of destructive drought, especially in the southern portions of the great valley. During the three years from 1868 to 1871, south of Monterey neither grass nor grain grew. The commissioners declare:

Hundreds of farms were abandoned, and the stock-men were compelled to drive their cattle, horses, and sheep to the gulches of the mountains, not only for food, but for water. In February, 1870, not a blade of grass was to be seen over the extensive valley of the Santa Clara; and the broad plains of Los Angeles, covering over 1,000,000 acres of arable land, were nearly desolate, even to the borders of the streams. From Tulare Lake to San Diego, the country was nearly desolate; and in March, 1871, the usual season when the crops should be luxuriant, not a blade of grass was to be seen over the great plains and through the valleys, which are richly covered after favorable rains. Hundreds of thousands of sheep, horses, and cattle were lost by starvation.

The practical deduction by the farmers in the southern part of the Great Valley is, that they can secure about two crops in five seasons; but this is still reduced in the extreme southern section, where we traversed ten to twenty miles at a time without a cabin to indicate a claim, yet the land was remarkably good. The great drought of the seasons of 1862–'63, 1863–'64, when only 13.6 and 10.1 inches of rain fell at San Francisco, was not so severely felt by the State, because the population was much smaller and grain-crops were not then so largely cultivated; but a recurrence of such years at the present time or in the future would be accompanied by the most disastrous results to the prosperity of the country, unless artificial means be adopted to secure the use of the waters from the streams.

In 1850 only 7 inches of rain fell at San Francisco. Such a season now, without irrigation, would produce a famine.

There is also a variation in the distribution of the rain-fall in different parts of the wet season. In some cases the greater portion is precipitated early in the season. If the grain is in the ground in time to receive the benefit of the earlier rains, the success of the crops seems to be assured; but if the sowing be delayed, a dry spring may entirely de-

stroy it in the drier portions of the Great Valley, and reduce it very low in more favored regions. The critical period appears to be from the middle to the end of February, when the grain is several inches high; one or two inches then would place the crops beyond danger from drought, but that small amount is often lacking, and the fairest prospects are blasted.

The commission believe that "the average yearly rain-fall over the basin of the Great Valley is sufficient to insure good crops annually." After a careful comparison of scientific observations, they place the average annual rain-fall of that portion of the Great Valley, including foot-hills north of the mouth of Sacramento River, at 23 inches, and of the southern part at 16 inches; the latter is probably in excess. It is to be noted, in this connection that, in both the northern and southern sections of the valley the flanks of the mountains, which enjoy the heaviest rain-fall, are more extensive than the central plains.

The amount of rain-water necessary to the growth of the crops also varies. At Visalia, the seasons of 1870–'71, and of 1872–'73 received, respectively, 6.8 inches and 7.2 inches, and in both these years the crops of the vicinity were failures. During the intervening season of 1871–'72 the rain-fall amounted to 10.3 inches, and the harvests following were abundant.

Throughout the southern sections of California crops have been secured when 12 inches of rain have fallen in the wet season; but the precipitation is not so reliably uniform as farther north. Farmers and stock men claim good crops with 15 inches of rain, if it has fallen somewhat evenly through the season. This amount would not be necessary to mature the crops, if, at the beginning of the rainy season, the earth had not been parched several feet deep by the excessive dryness and heat of summer.

The land cannot be plowed until the first rains have moistened the earth to a sufficient depth. During May, we (the commission) experienced a temperature of 130° in the sun between Bakersfield and San Emedio Cañon, and for months the temperature ranges over 100°.

But while the average rain-fall may be sufficient to secure good crops this fact will not secure the community against failure during the minimum years. The commission gave serious attention to this question. They examined the entire valley and foot-hills, and, from rough measurements of the catchments of all the principal and most of the smaller streams on both sides, they satisfied themselves that a system of irrigation, scientifically constructed, so as to utilize and economize the entire drainage, would furnish a good supply of water in all years. But such a system must be of the highest character. Very few of the canals already in operation are available for such an enterprise, having been constructed without regard to general interests, and many of them in defiance of the simplest principles of engineering science. To complicate the difficulties of the case, preposterous claims of "water-rights" are put forth by some landed proprietors, which, if allowed, will prevent the full development of a general system. Annoying litigation is expected from this quarter.

The Great Valley is admirably adapted to irrigation on the grandest scale. Its extreme length is about four hundred and fifty miles, with an average breadth of forty miles, including the foot-hills. Its longer axis is parallel with the coast-line and about eighty-five miles distant. The elevations of the valley range from 30 feet above tide-water, at Sacramento, to 282 feet at Kern Lake at the south end, and 556 feet at Redding at the north end. The mounstainrange are separated by an average breadth of one hundred and ten miles, with a length, from their north and south junctions, of five hundred and twenty miles. This includes an area of fifty-seven thousand two hundred square miles, equal to Illi-

nois or Michigan. The only gap in the encircling ranges is at San Francisco, and the entire drainage of the Great Valley is through the Golden Gate, a channel about one mile wide. The Sacramento Valley on the north has a smaller proportion of flat land. The Sacramento River receives no tributary of note during the first two hundred miles of its course northward of Feather River. It runs down a ridge along the middle line of the valley, and in the lower parts of its course is several feet higher than the land surface within three or four miles. These depressed areas constitute sloughs filled by overflows of the river and drainage of the mountains. The mountain-flanks on the west side are narrow and treeless, the rain-fall comparatively small, and the streams generally short, and dry in summer. The eastern declivity, from the river to the crest of the Sierra Nevada, is about twice as wide as the western, with a precipitation three or four times as great, as shown by the greater number and size of its tributary rivers. The mountain-flanks are well timbered and the foot-hills moderately so. The rivers are also fringed with narrow timber-belts. The San Joaquin presents the same general characteristics with the addition of a few considerable lakes. The area susceptible of easy irrigation is estimated at 7,650,000 acres, not including the swamp-lands, which raise the aggregate to 8,500,000 acres. It is practicable to extend the system to the foot-hills, thus making the total surface capable of irrigation about 12,000,000 acres.

There are about three square miles of catchment to each square mile of land to be irrigated. A monthly average of 3 inches' fall during the rainy season over the catchment area would give a depth of nearly 10 inches monthly over the irrigable area; but this is too large an estimate for a dry season. One day's discharge of Kern River alone, May 1, 1873, was estimated at a stratum of 3 inches over an area of 25,600 acres. It was doubtless much greater from the middle of February to the 1st of March. The eastern watershed of the valley to the north Kern River will yield more ample supplies.

The soil throughout the valley, with sufficient irrigation, is of prime fertility, promising an average of 30 bushels of wheat per acre, or its equivalent in other crops. Good cultivation on fresh soil, in years of ample rain-fall, produces still higher results, but unfortunately the cultivation of this region is mostly very poor and shiftless. Very large yields of grain are on record, showing something of the real capabilities of this fine region. With intelligent development of its resources, this great valley may become what Egypt was to the Roman Empire—the granary of the world. The application of water before the rainy season would enable the farmers to plow in time to receive the first showers, and thus expedite the growing season. The whole arrangement of farm-labor would be modified, to the advantage of the farmer, by the introduction of a permanent, unfailing supply of water, and the grain-raising interest would lose that element of speculative unsteadiness which has crippled it in the past. Farmers would no longer calculate the problem of chances like gamblers, but would have reliable data upon which to base their enterprises of culture. The influence of even the partial efforts at irrigation among farmers along the line of the San Joaquin and Kern River Canal shows something of the results that might be expected if a general system were adopted. At the cessation of the rains in February, 1873, the grain was in excellent condition, but a few weeks of drought, clear skies, and north winds turned it yellow and sickly. The farmers then determined to take the waters from the canal, and a few ditches were hurriedly cut. The water was applied in a very crude and wasteful manner. A single flooding restored the vitality

of the crops and made the wheat yield from 30 to 55 bushels per acre. Much of this land had previously failed to find purchasers at $2.50 per acre; its market price immediately rose to $25 or $30 per acre.

The commission were too much limited both in time and means to enter into details upon the various points of the practical problem they were called upon to study. These can be settled only by a careful instrumental reconnaissance and survey. A reconnaissance in the field could be made at small cost, but a definite survey would require a very considerable expenditure. This branch of the work might be accomplished by easy stages extended over several years, leaving the less important portions to the last.

The numerous and large tributary rivers on the east side of the valley forbid the construction of a long line of canal. The expense of bridging would be enormous. The system in this part of the valley must, then, embrace numerous short canals. Each river should be dammed at one or more points, and as high up as possible, in order to give a higher level to the water and thus irrigate a larger area. The proper location of these dams and the headworks and alignment of the main canals will constitute the most difficult and important engineering problem in the whole enterprise. The depressions of surface along the main streams below the water-level will require specific treatment. On the west side of the valley the alignment, size, and slope of the main canals are approximately indicated by the works already constructed. The construction of the canals will be less embarrassed by natural difficulties, and consequently will be less expensive than on the eastern side of the valley.

To allay the apprehension expressed in some quarters as to the injury to navigation in the rivers by the withdrawal of water for irrigation, the commission investigated, to some extent, the working of the systems of Italy and India. The percolation of subterranean water, from high grounds bordering the depleted channels in their higher levels, restores the average flow lower down. In the Great Valley of California but a small portion of the lower channels of the main rivers are at any time navigable, and the withdrawal of water for irrigation from their higher levels would probably soon be compensated by the drainage of subterranean waters. The working of some of the canals already constructed seems to confirm this probability.

The commission find it necessary to define in general terms the methods and works by which the irrigation of the Great Valley may be accomplished. The profession of hydraulic engineer is almost unknown in this country, nor do American farmers know how to use the water delivered to them. The works of private enterprise in California have been built under mistaken impressions as to the laws of hydraulics. In some cases the slope is too great, causing the banks to be washed away and the bottoms of the ditches to be scoured out, depressing the water-level too far for distribution over the surface to be irrigated. In other cases neglect of drainage has left surplus waters to stagnate in pools and to generate miasma.

The first point in a system of irrigation is to raise the surface of the water in the river to a level which will enable it to flow freely over the highest ground to be irrigated. This is usually done by a dam; but in the construction of dams, a great many mechanical, hydrostatic, and hydraulic principles must be applied under a great variety of circumstances. In the Old World, it is said, it is difficult to find two dams resembling each other. The size, alignment, and construction of the main canals constitute another branch of hydraulic engineering. The quantity of land to be irrigated, the nature of the soil, the minimum

rain-fall, the kind of cultivation to be applied, and other considerations must be embraced in the programme of construction. The subordinate channels which are to convey the water down to the plow-furrows require the application of scientific principles. The following specimen will show the methods which the commission consider practicable and suited to the peculiar features of the Great Valley. These methods are based on results of irrigation systems in the Old World. This specimen is taken from the works of San Joaquin and King's River Canal.

The main canal has a slope of 1 foot per mile, the ground sloping at the rate of 8 feet per mile. In the accompanying plat, the slope is shown by dotted lines at each foot of elevation. Water is not taken immediately from the main canals to the irrigated ground, but to the "primary ditches," which follow the highest part of the ground and are about a mile apart. The section is partly in excavation, and partly in embankment. As a general rule water should not be taken from primary ditches, but through secondary ditches. In this example (see plate on opposite page) the latter are about a quarter of a mile apart, running parallel, with a slope of 4 or 5 feet per mile. Each secondary ditch irrigates the land between it and the next one below it, embracing about 80 acres. The land is subdivided, first, by plow-furrows, 40 yards apart, parallel to the primary ditches, designated on the plat by the figures 1, 2, 3, 4, 5, 6, &c. It is again divided by cross-furrows, called "checks," 50 yards apart and parallel to the primary ditches, shown by the dotted lines 41, 42, 43, 44, &c. The secondary ditch, A B, has the capacity to fill ten boxes at the figures 1, 3, 5, 7, 9—19, leading into the plow-furrows. By closing the gate at the middle of the ditch, all its contents are discharged into the ten furrows above, through little gates at the head of each. The first "check-furrow" will arrest the flow and cause it to spread over the strip between it and the secondary ditch. When this is sufficiently irrigated, the check-furrow may be opened with the hoe, and the water will then overflow the second strip; and the process may be continued till the first 40 acres, represented by the parallelogram A C E D, are irrigated. Then close the small gates 1, 3, 5, &c., and open the gate at C in the secondary ditch, and in like manner irrigate the lower 40 acres C B F E.

As the ground slopes from the secondary ditches at the rate of 8 feet per mile, the level of each check-furrow will be 2.7 inches below its predecessor. There will then be an inequality of depth of water at different points of a strip between the two furrows, but in porous soils there is a compensation in the percolation of the water in the check-furrows to the land just below them. In impervious soils, or in irrigation for alfalfa, or permanent pasture, the furrows and check-furrows must be more numerous. The surplus water is caught in catch-drains for irrigating land further down.

The irrigation facilities of the east side of the Great Valley are difficult to delineate on account of the lack of official surveys. A few small canals have been constructed, but with no reference to a general system. In some cases mining-ditches have been converted into irrigation-channels. Each main tributary river will here require a main canal on each side extending below the base of the foot-hills till it meets similar canals from other rivers, the whole constituting a single main channel of supply for all the country between them and the main lines of drainage for the Great Valley. From them primary and secondary ditches will distribute the water over the soil with such local adaptations as may be demanded. A full exposition of the subject can be given only after an instrumental survey.

The commission have no doubt that the systematic irrigation of the region under consideration will ultimately be accomplished, but the cost will be enormous and beyond the financial resources of the present. It is not necessary, however, that the work should be all done at once. The population must be greatly increased to require it. To finish the work properly a period of fifty years will be necessary. It is of the first importance that it be properly planned and that the National and State Governments should act harmoniously in aiding and organizing it. Government authority is necessary in the location of the canals and ditches. The rights claimed by riparian proprietors should be appraised for public use, so that no single class of men may make the mere accident of their location a ground for the monopoly of what belongs to the community. The methods of distribution and the rights under it should be settled by law. A portion of the foot-hills will also demand irrigation, and the combination of this with the irrigation of the lower grounds will require authoritative settlement. Reservoirs will be demanded on the west flank of the Sierra Nevada for the storage of water, primarily for mining purposes, but subsequently for irrigation.

The withdrawal of water from the rivers for irrigation will tend also to reclaim the swamp-lands, by withholding and otherwise disposing of the surplus rain-fall, especially during the great floods. The elevation of the drainage river-channels above the neighboring lowlands renders it difficult to dispose of the overflows. If these can be kept back in the highlands and stored for future use in mining and farming enterprise, a very great collateral benefit will be secured in narrowing the area of swamp-lands, or of lands too wet for cultivation. At least a million acres of such land, endowed with the highest fertility, lie useless in the Great Valley.

The commission presents a brief *résumé* of the principles and practice of irrigation in Europe and India. Among the fundamental points of a successful system in the Old World is a sound financial basis. Without this any enterprise in this direction will infallibly bring disaster. Indian irrigation presents a marked illustration of this fact. Here it is the condition of existence both of people and government. More than half the public revenue comes directly from the products of the soil; even partial and local failures of crops in this vast country have been followed by famines from the lack of means of transportation. To obviate these mischievous consequences the government has spent $175,000,000 already, and is annually adding millions more in works of irrigation. These sums, at the prices of labor and materials in India, represent a vastly greater amount of work done than the same sums would secure in America. Skilled labor in India commands but 50 cents per day; earth-excavation may be done for 5 cents per square yard, and masonry at $1.50 to $2 per square yard. The work done is of the most permanent and excellent character, and more expensive than we would be willing to undertake on our western plains. The Ganges Canal, 10 feet deep and 170 feet wide, was intended to carry 7,000 cubic feet of water per second, and to serve for navigation as well as irrigation. Its original capital cost, not including interest, &c., was $12,000,000; in this country it would cost $100,000,000 to build such a one. Its length is greater than that of the irrigation-canals of Lombardy and Egypt combined. It was built to irrigate 1,500,000 acres. In 1864, 12 per cent. of the land irrigated by it was in sugar-cane, paying a fee of $2.20 per acre; 20 per cent. in gardens, at $1.25 per acre; 51 per cent. in indigo, cotton, &c., at 80 cents per acre; 17 per cent. in grain, at 60 cents per acre. The mean price obtained was $1.02 per acre. In 1866

and 1867 the mean price was $1.21 per acre, half of which was sufficient to pay the cost of maintenance. Some faults in engineering have added unnecessarily to the cost of both construction and maintenance. It required ten years to reach its probable ultimate area of irrigation. These enterprises have generally been slow in the development of their beneficent capacities. The limits of this article will not admit noticing any other of the splendid irrigation-works of India. The capital invested in construction, up to the close of the administrative year 1871–'72, is stated at $53,295,000. To construct such works in this country would probably cost $400,000,000. Their net income was about 8 per cent. per annum, including increase of land revenue, &c. Some of these works, however, were old irrigation-works, constructed under former native dynasties, and the outlay by the present government consisted only in extensive repairs. Increasing experience is teaching practical methods of utilizing water, so as to make the same supply serve much greater areas. Many private enterprises have also been started, but the authorities express the "growing conviction" that this policy should be abandoned. Some of these works were purchased by the government, leaving but one private enterprise, the Madras Company, furnishing water to any extent.

Italy, though enjoying a much larger annual rain-fall than California, found it necessary to resort to irrigation hundreds of years ago. Lombardy and Piedmont average about 37 or 38 inches of rain-fall per annum, the most of which is within the irrigating months from March 1 to October 1, during which there occur, on an average, 71 rainy days. The mean temperature of the irrigated districts from May to August ranges from 70° to 90° F. The south end of the Great Valley of California averages about 10 inches of rain-fall, with a minimum of 5 inches, and 275 clear days in the year; temperature 100° in the shade for sometimes two hundred days together, with a maximum reaching occasionally to 130°. In Orissa, India, with a rain-fall of 60 inches, there was a great famine. In California an average of 15 inches secures good crops. These facts show that it is not so much the amount as the distribution of atmospheric moisture that affects the prosperity of agriculture.

The Italian canals employ for irrigation an aggregate flow of 24,000 cubic feet of water per second during the season for 1,600,000 acres. It is estimated that 1,000,000 acres in Lombardy are irrigated by works costing $200,000,000; but this expenditure, having been spread over several hundred years, has not been felt very severely. The canals are chiefly owned by government. Here, as in India, it has been found that private enterprise has not been successful in the management of these works, at least so far as the public interest is concerned. Prominent among them is the great Cavour Canal, fifty-five miles long, 131 feet wide at the bottom, and 6 feet deep, with a general slope of 1 foot in 4,000. Its alignment is perpendicular to the lines of natural drainage, necessitating the construction of a large number of costly bridges, aqueducts, &c., and involving an enormous cost. A canal skirting the western foot-hills of the Sierra Nevada, and crossing by aqueducts the parallel tributary streams, would be a still more formidable undertaking of the same character. The Cavour Company became bankrupt, and its property passed into the hands of its creditors. Its failure was partly occasioned by unskillful financial management, but more largely by incompetent engineering. Among the fatal blunders in the scientific data was the estimate that the Po, from which the water of the canal was obtained, carried a flow of 4,000 feet per second in

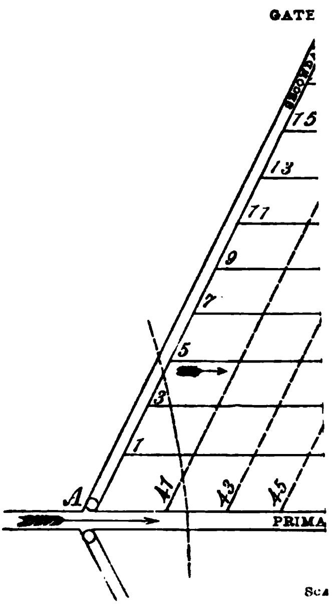
its lowest stage, whereas it was discovered to be as low as 1,500 feet per second. Italian canals are usually farmed out to contractors for a period of nine years. The contractors arrange terms of supply with the cultivators, who are formed into associations representing particular districts. Each district association administers the distribution of water within its own limits, subject to regulations prescribed by the government.

Cereals and most other products require some irrigation in Italy, but the greatest amount is for rice-culture in summer and meadows in winter. The meadow-grass, called marcite, requires the continuous passage of a thin film of water, except at the cuttings, which is secured by arranging the land in planes about 30 feet wide, with a slope of 1 foot in 12 or 15; these are watered by small irrigating-channels on the crest. A cubic foot of water per second, properly economized, will irrigate three acres, securing an enormous product. The meadows near Milan are cut seven times a year, yielding 50 tons per acre per annum, rising, in exceptional cases, to 75 tons. The meadows are also fertilized by the sewage of Milan through the channels of irrigation.

The climate of Spain resembles that of California both in its high temperature and in its small amount of rain-fall. Here judicious irrigation exhibits remarkable results. Near Valencia irrigated land sells at $700 to $900 per acre, and, at a considerable distance, brings $400 to $500, while unirrigated land scarcely commands $80. Near Madrid irrigation increases the value of land from fourfold to tenfold. In the valley of the Tagus irrigated land yields twelve times as great a product as unirrigated land. "Spain may be described as a country in which the water is more valuable than the land in the ratio of 5 to 20"—a popular estimate, resulting from a thousand years of study and experience. Its system of irrigation is a legacy of the old Moorish *régime*. The legal relations of land and water are varied. In some localities the irrigation facilities are legally associated, so that even the proprietor cannot sell one without the other. In other places the farmer buys the water as merchandise. In dry seasons, the prices paid have been enormous. In 1861 they averaged $11,000 for a cubic foot per second through the year from the old irrigation-canals. In the later works, however, government has fixed the prices. The Henares Canal is allowed to charge $1,875 per cubic foot per second through the year; in Italy the same quantity brings only $75 to $80. The old Moorish works are generally the property of the irrigators, who pay only just what is necessary to keep them in repair.

In France there are no government canals; they are generally built by the land-owners. The government, however, exercises a closer supervision over their construction and operation than in Spain. They are periodically inspected by government engineers. French law, unlike Spanish law, does not permit a majority of proprietors to establish an irrigating system and then compel the minority to bear a portion of the expense. In the case of the Carpentras Canal the government agreed not to increase the land-assessments for twenty-five years after its completion.

In estimating the quantity of water needed for irrigation in the Great Valley, the commission allow 15 per cent. for loss through evaporation and absorption of banks and beds of canals. The California rivers usually run full for seven months. The streams of the Sierra Nevada, with immense reservoirs of snow, are in full volume from December to August, and may be calculated upon for a full supply of water during two hundred days of the year. A discharge at the rate of a cubic foot per second, during fourteen hours per day, would amount to 50,400 cubic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feet per day, or 10,080,000 cubic feet per annum. Deducting 15 per cent. for evaporation and absorption, there remain for actual irrigation 42,800 cubic feet per day, and 8,568,000 cubic feet during the season. Each day's supply at this rate will furnish a sheet of water covering six acres 2 inches deep. The annual supply would furnish 200 acres with 12 inches depth. A cubic foot per second, then, is regarded as a sufficient supply for 200 acres, allowing for waste and uncultivable land.

Wheat sown in October or November, on summer-fallowed land well watered during the high river stages, will generally make a good crop, even with a short supply of rain for the season; sown in January or February, it will need one or two irrigations of 3 inches each; for later crops, 12 inches will be necessary. On reclaimed tule-land, barley, sown after wheat-harvest, comes to maturity. Cotton will require more water than grain. Alfalfa, cut five times, will require 12 inches in addition to the rain.

The allowance sufficient for the present demands of agriculture may not be sufficient for the future. This should be taken into account in arranging the system of irrigation in the Great Valley. In seasons of scarcity, the question may arise whether the small supply be distributed over the whole irrigable region or concentrated on a portion of it. In other countries the usages are exceedingly various, and furnish but few general principles applicable to our peculiar circumstances and necessities. In North India, a cubic foot of water per second suffices for 200 acres of cereals. In Granada and Valencia, Spain, 240 acres; in Elche, Spain, 1,000 acres, water being very scarce. Rice-fields in different parts of the world vary from 30 to 80 acres per foot. In recent Spanish grants the legal quantity varies from 70 to 260 acres per foot.

In the proposed system the secondary and tertiary channels will be constructed by the cultivators themselves, and the work can be made to occupy seasons of leisure by farmers working their own land. The case, however, will be different for farmers on a large scale who are compelled to hire labor. The cost of the main canals and primary ditches will be borne by the Government or corporations furnishing water. The cost of these works and of the head-works by which they are supplied must, of course, vary under different circumstances. The commission estimates that a canal carrying 315 cubic feet per second, deducting 15 per cent. for evaporation and absorption, will irrigate 53,600 acres. Supposing all the land to lie on one side of the canal in a strip five miles wide, each mile of canal will require five miles of primary ditches. Each mile of canal will then irrigate 3,200 acres; or, allowing one-fourth for waste and uncultivable lands, lands occupied by buildings, yards, &c., 2,400 acres. Primary ditches of the capacity of 50 cubic feet per second will cover 2,400 acres, 3 inches deep, in seven days and nights. Six of the primaries can be filled at once by a canal of the above capacity, serving 14,400 acres in seven days and nights; in twenty-six days the whole 53,600 acres may be irrigated; but, if the water is used only fourteen hours per day, forty-five days will be required.

Each 2,400 acres, then, is supposed to require one mile of main canal and five miles of primary ditches. In the most favorable case of construction, in which excavation and embankment are about equal at thirty cents per cubic yard, the cost per acre irrigated will be about $5. Adding the expense of dams and head-works, the extra excavation and embankment required by inequalities of ground, bridges, sluices for drainage, &c., the expense will be about doubled, amounting to $10 per irrigated acre. Some portions of the east side of the San Joaquin Valley are underlaid at 2 or 3 feet depth by hard strata, requiring blast-

ing. This will enlarge the cost 25 or 33 per cent. Foot-hill irrigation will cost still more. The cheapest canal in Spain cost $15 per irrigated acre, with labor much lower than in California, but in this case the dams and head-works are of the most permanent and substantial character. In California it is proposed to construct the dams of wood and rebuild them after decay sets in, thus postponing a large part of the permanent outlay. In the old countries there are no lands of easy irrigation left. Most of the late constructions are very different in character from what would be required in California.

The commission finally state their conclusions *seriatim*, of which the following summary is presented. There are large bodies of fertile land in the Great Valley needing irrigation, and the natural features of the country favor the enterprise. The east side of the valley will give an abundant supply of water through canals from the various rivers. The supply of the west side is smaller, but sufficient to irrigate a very large body of land. The San Joaquin and Tulare Valleys, especially, would increase their production many fold with irrigation. The cost would be great, but not out of proportion to the benefit, derived. Irrigation is but little understood by either farmers or engineers in this county. The experience of other countries shows that this work can be effectually done only by the government. State and national governments should at once combine their efforts to inaugurate this enterprise by an instrumental survey to ascertain what lands are irrigable, and at what expense of construction; the amount of water that can be furnished each tract of land, the best methods of delivery, probable cost, &c. All accessible information from foreign irrigation systems should be gathered and disseminated. A system of uniform laws and regulations should be established. In isolated localities cultivators should be allowed to appropriate the waters of small streams, provided their works do not interfere with the general system. Land and water should be inseparably united. As the lands receive the special benefit of irrigation, it is but fair to lay upon them a large part at least of the expense of the machinery. The general increase of revenue, however, would justify appropriations from the general tax fund of States and counties. There is, however, a difficulty in the fact that many lands at present are not worth $5 per acre, and that irrigation established for their benefit will probably cost double that sum. Aid from Government should be cautiously given. In some cases corporations may be allowed to furnish the water of irrigation, under definite regulations. There is no reason, however, to suppose that capital will find works of this kind a very attractive investment. The work must probably be done by Government. The State should exercise a supervision of all such works, however distasteful to interested parties.

IRRIGATION: ITS EVILS, THE REMEDIES, AND THE COMPENSATIONS.

By George P. Marsh.

I.—GENERAL CONSIDERATIONS.

1. Irrigation, or the artificial application of water to growing crops, is one of the most primitive of agricultural arts, and in the regions which were the first seats of civilization, reservoirs and canals for collecting, storing up, and distributing this fertilizing element are among

the most ancient human constructions of which visible remains are still extant.

It is probably chiefly to a sense of the agricultural value of water that we are to ascribe the religious reverence paid to fountains and rivers in the early ages, and which is still traceable as a fading superstition in the names of many holy wells and saints' fountains.

2. The moist atmosphere of the countries whence our population is chiefly derived—the British Islands and the Germanic provinces—and the plentiful summer-rains of our Atlantic States, have rendered agriculture practicable in all these lands without a resort to the expensive and laborious arrangements involved in rural husbandry, which derives its necessary supply of water not directly from spontaneous rain-fall, but from human art. Hence, except in garden-cultivation, and perhaps some other comparatively unimportant branches of agriculture, irrigation has been hitherto practically almost unknown to us.

3. But in many parts of Spanish America artificial watering of the fields has always been as indispensable to successful agriculture as in the Hispanic Peninsula, and our recent acquisition and settlement of a considerable part of the Mexican territory, where the climate makes irrigation a necessity, is now familiarizing us with the practice. Besides this, both in Northern Europe and in the older United States the opinion is fast gaining ground that running, or at least infiltrated water, may often be advantageously supplied to grasses and cultivated vegetables in climates and on soils where precipitation alone was formerly regarded as a sufficient source of moisture for all the field-crops. Irrigation is consequently now more or less practiced, and its use is rapidly extending in all the European countries to which I have referred,* and there is a strong disposition in the Eastern States of the American Union to test the value of the practice by actual experiment, not merely in market-gardening, but in field-culture, on an extensive scale.

4. There is some danger that, with our characteristic impetuosity and love of novelty, we shall, especially in the comparatively rainless new States and Territories of our vast empire, engage too largely and too inconsiderately in an agricultural process which, in many cases, may be attended with disadvantages more than sufficient to counterbalance the gains from its adoption. At least we may fear that costly arrangements will sometimes be made when simple and less expensive methods would be equally available; and we have reason to apprehend that the acquisition of the control of abundant sources of water by private individuals may often result in the establishment of vested rights and monopolies liable to great abuse, and at the same time calculated to interfere seriously with the adoption of general systems of irrigation.

5. Information in regard to European methods of accumulating and distributing the water of precipitation, and of flowing springs and rivulets, for agricultural purposes, is readily accessible, and in the practical employment of the system our engineers and the ingenuity of our people will no doubt easily overcome any special difficulties arising from the pecular geographical and meteorological features of our territory. But the social, legal, sanitary, and financial aspects of the subject in its application to extensive tracts of cultivated land are not familiar to the American public, and for the moment some cautions, of a not altogether obvious nature, are more needed than instructions on points of practical method, or of adaptability to particular branches of agriculture.

6. I propose, then, to point out the evils and difficulties of the prac-

* The quantity of irrigated meadow-land in England and Germany is already very large, but the application of water to tilled field-crops is now much less resorted to in those countries.

tice of irrigation, and to suggest precautions against the occurrence of these evils, and means of palliating them where they are to some extent inevitable.

II.—MORAL AND SOCIAL EFFECTS OF IRRIGATION.

7. In a political community where it is now generally admitted that *persons* necessarily have inalienable *rights*, of an extent commensurate with their natural duties and necessities, and that consequently no man or body of men can rightfully use any other man or men simply as a means to a selfish end, it will be allowed that, in the introduction of new systems of industrial or rural occupation, on a scale large enough to affect the rights and interests of whole classes of the population, equal regard should be paid to the good of every class, and few will deny that on all such occasions the moral, social, and sanitary consequences of great changes in the habits and employments of large bodies of the people should be considered as of more importance than the merely financial results.

8. In this, as in most other cases of inquiry into questions of political economy, in the present state of that science, we encounter at the outset the great enigma of the right relations between capital and labor—which is really a moral rather than a financial problem—and there are not many instances where those relations are on the whole more unsatisfactory than in the employment of irrigation on the great scale in which it is practiced in many parts of Europe.

9. With an important exception, which I shall notice hereafter, the tendency of irrigation as a regular agricultural method, is to promote the accumulation of large tracts of land in the hands of single proprietors, and consequently to disp ssess the smaller land-holders. Where a district, however large, derives its supply of water for irrigation from a single stream or lake, not of such volume as to be practically inexhaustible, the interests of production require that the husbandry of the entire district be administered on a uniform, or at least on a harmonious system, and consequently that the control of the source of water-supply be vested in a single head. If we suppose a considerable district, with a conveniently accessible water-course of a volume just sufficient to supply it if judiciously distributed, to be owned in severalty by ten different proprietors, it is obvious that each land-holder cannot be allowed to draw off at his pleasure and appropriate to his own use the whole current, or such part of it as may suit his convenience, but the quantity and periods of diversion must be regulated upon some general system established by law, custom, or contract for the whole district. The course and capacity of the channels of diversion and of final discharge must be determined by some common principle, and adapted to the branches of husbandry best suited to the soil and climate. It would, in practice, be a matter of extreme difficulty to bring about an agreement between any ten cultivators so situated in regard to the location of such channels, the apportionment of the cost of construction and maintenance, and the assignment of the times of diversion, and the quantities of water to each individual land holder. Again, these times and quantities must be accommodated to the special crops to be watered, and of course any change in the order or objects of rural husbandry would require a change in the seasons and amount of supply. Hence, the agricultural economy of each farmer must remain substantially fixed and invariable, and even so simple a thing as the rotation of crops would be almost impracticable, because it would be impossible to change the whole syetem of supply to suit the interests of a single one of the own-

ers. The canals of diversion and distribution once established, the net work must consequently remain as immutable as the arteries and veins of the human system.

10. Besides this, the measurement of flowing water, and of course its division between different occupants, are matters of extreme complexity, and there would be constant jealousies and dissensions between neighboring claimants in regard to the ascertainment of the quantity rightfully belonging to each, and of the amount actually withdrawn by each from the common source of supply.

11. I have thus far supposed a case where, as is usual in the United States, streams not navigable are not the property of the State, but are owned either in severalty or by different private proprietors in common. European experience shows, as might be expected from what has just been said, that under such circumstances, as well as where waters belonging to the State are farmed and relet by private individuals, water-rights are a constant source of gross injustice and endless litigation.* The consequence of these interminable vexations is that the poorer or more peaceably-disposed land-holder is obliged to sell his possessions to a richer or more litigious proprietor, and the whole district gradually passes into the hands of a single holder, or family, or corporation. Hence, in the large irrigated plain-lands of Europe, real estate is accumulated in vast tracts of single ownership, and farming is conducted on a scale hardly surpassed in England, or even on the boundless meadows and pastures of our own West.†

There are doubtless considerable economical advantages in the system. The unity of administration tends to increase production as well as to diminish the cost of agricultural operations, but the evils more than counterbalance this advantage. In an often-quoted passage Pliny, the elder complained, eighteen hundred years ago, that great farms had been the ruin of Italy, as well as of the tributary territories. He adds, in a paragraph not so frequently cited, that six land-holders own one-half of the Roman province of Africa, and he thinks it a proof of magnanimity in Pompey that he would never enlarge his farms by buying land adjacent to them.‡

13. The ruin to which Pliny alludes was not merely from the negligent management of non-resident landlords. He refers rather to the demoralization of the peasantry, in consequence of their abandonment of their native fields and firesides. The small cultivators who sell their paternal acres must either emigrate, and so diminish the resident population, or sink from the class of land-owners to that of hired laborers on the fields which, once their own, are their homes no longer. Having no proprietary interest in the soil they till, no mastership over it, they are, as I have said elsewhere, virtually expatriated, and the middle

*Niel cites a case where a gentleman, who had farmed from the government a tributary of the Po, allowed, out of some private spite against a neighbor, a considerable portion of the water he controlled to run to waste for a period of eight years, though offered by his neighbor twelve thousand francs a year for the use of what he thus wantonly threw away. Note in *L'Agriculture des Etats Sardes*. Turin, 1856, p. 229.

† About ten years ago a single proprietor exhibited, at an agricultural fair at Modena, one hundred yoke of oxen from his own estate.

‡ The passage is somewhat pharaphrastically thus translated by old Holland: "Confess we must needs that these large inclosures and great domaines held by privat persons have long since been the ruine of Italie, and of late daies have undone the provinces also thereto belonging. Six landlords there were, and no more, that possessed one moietie of all Afrike. * * Where, by the way, I may not defraud Cruius Pompeius of the due glorie answerable to that greatness of his, who never in all his life would purchase any ground that butted or bordered upon his own land." (Hist. Nat. Lib., xviii, c. 7.)

class, which ought to constitute the true moral as well as physical power of the land, ceases to exist and enjoy a social status as a rural order, and is found only among the trading and industrial population of the cities.*

III. SANITARY EFFECTS OF IRRIGATION.

14. Next in importance to the moral and social aspects of the system we are considering comes the question of the effects of irrigation on the health of the population employing it. In certain branches of agriculture, where water is largely used for irrigation, as in the growing of rice, or in preparing the product for market, as in retting hemp, nothing can be better established than the fact that the miasmatic exhalations from the soil and the pools are deleterious in the highest degree. The rice-grounds of Lombardy, though principally lying to the north of the forty-fifth degree of latitude, are almost as destructive to health as those of Georgia and our other Southern States, and the statistics of the increased mortality attending the recent extension of rice-culture in Northern Italy are truly appalling.†

15. But all irrigation, except where the configuration of the surface and the character of the soil are such as to promote the rapid draining of the water, or where special precautions are taken against its influence, is prejudicial to health. In most localities the increased dampness of the atmosphere is injurious to the respiratory system, and in others the exhalations from the watered soil and moistened manures tend powerfully to favor the development of malarious influences, and to aggravate, if not to occasion, febrile diseases.‡

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* In Tuscany and in other parts of Italy, where the system of farming upon shares, or *mazzadria*, *mezzeria*, or *masseria*, as it is called, is general, the families of peasant-tenants frequently remain for generations, and even for centuries on the same small farm. As a rule, only one son marries, and the others live with him, after the death of the father, rather as farm-servants than as joint partners. A young peasant who refuses to conform to this custom, and seeks occupation elsewhere, generally becomes what is called a *bracciante*, or day-laborer, and, as the evil habits into which such youths very commonly fall are regarded as either the cause or the consequence of their departure from the established usages of their class, they are looked upon with little respect, and *bracciante* is almost a term of reproach. If a *braccianti* marries, he is obliged to rent a cottage on the outskirts of some town, for he can rarely find a landlord who will receive him as a farm-tenant on the usual terms, and he is reduced to precarious day-labor or to mendicancy, as a means of livelihood. "What does your father do?" said I to a beggar-boy in Tuscany. "Is he a peasant?" "He does not do anything," replied the boy. "He is a renter, (fittajuolo:) he goes a begging."

Persons interested in peasant-life in Europe will find an admirably full and satisfactory account of the rural system in Tuscany, in all its relations, moral, social, and economical, in Toscanelle's most interesting *Economia Rurale della Provincia*, Pisana, 1 vol, 8vo., with a quarto atlas of plates. Like information, though less comprehensive respecting the peasants of the French Alps is given in LA DOUCETTE *Les Hautes Alps*, &c. The moral and material life of the peasants of North Sealand is sketched with great fidelity in Iunge, *Den nordsjellandske landal Puess charaktaeer skikke*, &c., 2d edition, Kjöbenkawn, 1864.

† Rice-growing is extremely profitable in Italy, and consequently the temptation to extend it is found irresistible. It was formerly confined within narrow limits by restrictive legislation, but the laws have been modified so as to leave the decision of questions of extension to the discretion of the local authorities, who are too often under the influence of large proprietors, and, in spite of the remonstrances of political economists and of medical men, the area occupied by rice-fields is fast extending. The labor in these fields is, in great proportion, performed by men and women who come down from the mountains for that purpose at the proper season, and this branch of agriculture has acquired such prominence in the eyes of the mountaineers, that the vast alluvial provinces, elsewhere called the "plains of Lombardy" are popularly known in the Alpine villages, which supply them with laborers, as "*le Risaje*," the rice-grounds.

‡ There is no doubt that the insalubrity of Rome, though certainly not entirely due to this cause, is greatly aggravated by the abundantly-irrigated gardens within the walls of that city. Is not the increased prevalence of malarious fevers in the neighborhood of New York and other American cities due in part to the increased extent of market-gardens, and consequently of irrigated lands, in their vicinity?

IV.—PHYSICAL EVILS OF IRRIGATION.

16. From these brief hints at some of the moral, social, and sanitary disadvantages which, under the circumstances supposed, attend the system of husbandry under consideration, I proceed to some notice of the purely physical evils which, in many cases, are inseparable from it.

17. The first and most obvious effect of withdrawing water from its narrow natural channels, and distributing it over the surface of the earth, is a great increase in the humidity of the soil watered, a like increase in the evaporation from it, and a corresponding reduction of the atmospheric temperature, as in other cases of evaporation.* The water imbibed by the earth, which on grounds of slight inclination is generally estimated at about one-seventh of the quantity applied, may not be sufficient to affect the consistence of the soil to a serious degree, but the remaining six-sevenths, so far as not carried off by evaporation, employed to irrigate lands at a lower level, or discharged into running streams or lakes, frequently produce a very prejudicial effect on the soil of adjacent grounds, over which the water flows or into which it percolates. Thus the infiltration of the superfluous water from the rice-grounds of Lombardy, it is said, sometimes renders the lower fields adjacent unfit for any other husbandry to a distance of even miles from the lands flowed for watering the rice.†

18. The diversion of brooks and rivers from their natural channels, and the final discharge of the current by remote outlets, tend to deprive the district originally watered by it of their proper supply, and while on the one side considerable tracts of ground are sometimes drenched with superfluous moisture, on the other, water-courses large enough to drive mills and other machinery may be laid dry and their fish destoyed, and even the subterranean conduits from their beds, which fed springs and wells at lower levels, may cease to flow.‡

19. It has been a general opinion among practical agriculturists that the water employed for irrigation dissolves some of the fertilizing ingredients of the soil to which it is applied, and carries them with it in its flow or percolation over or through the adjacent fields into which it es-

* Special observations on the effect of irrigation on local temperature have not, so far as I know, yet been undertaken, but I have often found that the summer-morning temperature of an irrigated district in Italy was several degrees lower than that recorded at the meteorological station in an adjacent city. The evaporation from grasses and cultivated plants is much stimulated by the increased supply of moisture they receive from irrigation, and as the water applied is in motion and spread over a wide surface, it gives off more vapor than when in its original channel or reservoir, or than could be exhaled by an unwatered soil. This evaporation is necessarily attended with a local refrigeration, and at the same time with an augmentation of atmospheric moisture, though the rapid rise of the vapor to inaccessible heights, and the movement of air-currents, may prevent this latter effect from being obvious to ordinary meteorological tests.

† On what is called the *reproduction* of water employed for irrigation, see M. Vigan, *Étude sur les irrigations des Pyrénées orientales.* Paris, 1867. Pamphlet.

‡ Irrigation always compacts and hardens the soil, and sometimes to a very inconvenient degree. I have often observed that the alluvial bottoms of the Valderno had become by long watering as hard and refractory as the notorious "white-faced clay" of the limestone district of New England. This, of course, much increases the labor both of plowing and of the subsequent tillage with hoe or cultivator. This effect of irrigation would be much less sensible but for the fact that where watering is employed in field-cultivation, farmers are tempted to rely too much on the fertilizing power of irrigation, and consequently to use little manure. Land properly enriched by a liberal application of manure, is much less liable to become hard and tenacious by watering. Of course land is softened for the moment by watering, though in drying it becomes harder than before. It is customary in some parts of Tuscany to irrigate the ground after taking off a summer crop, in order both to soften it for plowing for autumn-sowing, and to hasten the sprouting of the winter-grain sown upon it.

capes. Hence a higher value has been ascribed to such escape-water in its subsequent use than in its original application. This opinion was controverted by Liebig, who taught that none of the material constituents of vegetation were thus abstracted by water, and his views have been confirmed by other observers. Later experiments appear to show that the doctrines of Liebig and his followers are not strictly true, for mineral and vegetable substances which enter more or less into the food of plants have been detected in the water of field-drains and other currents from cultivated soil. Still there is no satisfactory evidence that land is on the whole impoverished by irrigation, though the consistence of the soil may sometimes be affected injuriously by it.*

20. The increase of the natural humidity of the soil provokes the growth of aquatic weeds, and although some English writers have asserted that the *marcite*† or water-meadows of Lombardy are not infested with these pests, I believe they are kept free from them only by constant wedeing. In the rice-fields the extirpation of such plants, which is performed wholly by hand, is perhaps the most laborious and unhealthy of the toil of the cultivator, and in all freely-irrigated lands the borders of the channels of distribution are fringed with water-plants, in spite of all efforts to destroy them, and they mark every spot of pasture and meadow surface where the flow or percolation of the water is checked by superficial or underground obstructions.

21. In many localities irrigation cannot be carried on upon a great scale without the construction of large reservoirs for retaining the precipitation of the wet season for use in the dry, and in all oriental and many European countries such artificial lakes are counted by thousands. Irrigation from reservoirs has most of the general inconveniences which attend other systems, with the additional disadvantages that it is found in practice almost an impossibility so to secure the retaining dams or walls that they do not at length burst their barriers and overwhelm the country below with ruinous desolation. Treatises on hydraulics are full of fearful examples of such calamities, and the construction of works of this sort ought never to be permitted except with guarantees and under circumstances which promise exceptional security.

* Many of the inconveniences resulting from the division of superficial water-courses from their natural channels as respects the supply of lower grounds originally watered by them are sufficiently familiar, but the dangers of interfering with the underground circulation are far less obvious. The water of rivers is usually absorbed by their beds in large proportion, and though it is frequently partially restored to the channel at lower points by subterranean conduits, yet much of it always escapes laterally and is conveyed to great distances by infiltration. In fact the supply for wells and springs upon the plains is principally derived from this source, for it is only on porous or fissured soils that much rain-water descends to considerable depths, most of the precipitation being carried off by superficial flowage or evaporation. Hence the abstraction of the current of a mountain-stream may dry up wells and springs lying miles from its bed, and this not merely from a change of the channel of the water, but because in employing it for irrigation it is spread over a larger surface, and, of course, more of it is taken up by evaporation. The consequences of such diversion depend much on the character and inclination of the underlying strata, and as these are usually imperfectly known, it would very rarely be possible to predict how the ground-water of a given district would be affected by the diversion of streams flowing at a higher or even the same general level. The injury to a particular tract of land, from cutting off its underground supply of water by turning brooks away from their natural beds, is sometimes partially compensated by the creation of springs elsewhere from the infiltration of water spread over the surface for irrigation.

† The *marcite* of Lombardy are grounds of comparatively small extent, kept always in grass, and almost constantly overflowed with water from springs of a temperature above that of the ordinary sources in that climate. The grass is cut five, six, or even more times in a season, and seldom made into hay, but fed green to stalled cattle. Horses refuse it. It is not profitable to raise—or, as foreign guests at Italian tables have too often occasion to lament, properly to fatten—calves in Lombardy, and the cows which furnish milk for the justly-celebrated dairies of those provinces are, for the most part, annually imported from Switzerland.

22. The quality of the grain, roots, and other vegetables cultivated by irrigation is a point of importance, but not hitherto sufficiently investigated. I cannot say that I find the meal of Indian corn or other cereal grains grown in countries where irrigation is generally practiced less sweet or less nutritious than that produced on our unwatered fields. The wheat of Italy is excellent, and the bread of Andalusia is generally admitted to be both more agreeable to the palate and more nutritious than that of any other country. But water is sparingly applied to maize, and then only in times of drought, and by infiltration from currents conducted along the furrows, and wheat is hardly watered at all except occasionally in the southernmost provinces of Europe. The grasses of irrigated meadows, especially where, as is apt to be the case when the supply is abundant, water is too freely applied, though luxuriant in growth and of good quality for soiling or feeding green to horned cattle, certainly make hay much less nutritive and less tasteful to stock than that grown on ground watered only by rain.* All American travelers find the garden vegetables of continental Europe, peas, beans, tubers, and roots, far less savory than with us, where water is indeed often applied to them, but in much smaller quantities; and it is further observed that though garden-seeds from the United States may produce a single crop of satisfactory quality in a well-watered Italian garden, yet the vegetables grown from the same stock in the following years rapidly deteriorate. Neither I, nor the friends to whom I have given seeds, have been able to obtain anything but stringy pods, even for one season, from American okra-seed; and the lima bean has greatly diminished in productiveness, size, and flavor, and, in fact, has almost entirely run out, after a few years of partial success in Tuscany.†

V.—ECONOMICAL OBSTACLES TO IRRIGATION.

23. Let us consider the question from a purely economical point of view. Irrigation is seldom practicable without a considerable pecuniary outlay in arrangements for collecting and distributing the water, whether derived from springs, lakes, wells, or precipitation. Dams, dikes, artesian borings, common wells, pumping machinery, reservoirs, aqueducts, siphons, and canals, or some of them, are indispensable whenever irrigation is employed in any cultivation more extensive than ordinary gardening.

24. Besides this, the ground to be watered must be leveled, graded, or scarped, in order to permit either the flow of a current over its whole surface, or its gradual absorption and infiltration from the channels into which it is conducted. In new countries, and especially on lands originally wooded, ground is almost always extremely irregular, from the

* "Moderate irrigation of herbaceous plants accelerates t eir germination and growth; but it checks the ripening of their seeds, and if water is applied in excess it renders their texture less firm and substantial, and at the same time more subject to decomposition and waste."—Firenze, 1870, p. 111. Cuppari, Manuale dell' Agricoltore.

† I have never experimented on American sweet-corn in Italy for more than a single season without renewing the seed; but Italian friends to whom I have given the seed inform me that though the first crop is excellent, it rapidly degenerates. Perhaps, by longer trial and with more caution in the use of water, all these American garden-vegetables would accommodate themselves to the climate of Italy, and recover their original qualities. The onion, perhaps for the very reason that deprives some other vegetables of their agreeable taste, is much improved by free irrigation. The strong flavor so objectionable in the American onion is, as it were, washed out by watering; and the Italian and Spanish onion may be employed in refined cookery with comparatively little offense. It is a point of importance to ascertain how the quality of the sugar-beet is affected by irrigation.

growth of trees and the spread of the roots, which occasion great irregularity of surface, from bowlders, or the cropping-out of rock, and from other familiar causes. It is obvious that over the hollows and ridges of such a surface, water cannot be evenly and gradually distributed, and measures must be taken to convert the broken curves and ridges of the ground into comparatively uniform slopes. This, indeed, is effected in a certain degree by the ordinary operations of agriculture, and every farmer knows that an old field is much smoother than a new one. In fact, few things in the long-cultivated regions of the Old World strike the eye of an American farmer more powerfully than the regular slopes and long sweeps of the surface. These outlines are in part the result of special labor devoted to that object; but they are, in a still higher degree, perhaps, the effect of centuries of cultivation under the spade, the hoe, the plow, and the harrow, none of which can be long employed without producing a smoothing-down of the original asperities and irregularities of the ground.* The natural surface, then, except on alluvial plains, is usually unfavorable to the application of water to grass, or tilled crops grown upon it; and there are many regions in the United States where cultivation has not yet reduced the face of the earth to the necessary regularity, and where, of course, a good deal of labor must be performed in the way of grading before irrigation can be practiced with advantage.†

25. All artificial arrangements for irrigation are costly, and, of course, especially in a new country, where much building and other improvement are necessary, so far objectionable. The expenses incurred in them do not belong to the current *annual* account, but the works are generally of a permanent nature, and are therefore so much added to the capital invested. Hence settlers of limited means cannot engage in them, and small land-holding is discouraged. Besides this, the time and attention consumed in watching the canals and in admitting and shutting off the water are considerable, and where hand-labor is so dear as with us, this item would be found a not unimportant addition to the cost of agricultural operations. It is for such reasons that European economists discourage the execution of works for irrigation, unless where an abundant supply of water can be certainly counted on. Boussingault, for instance, states that cheap as is labor in Germany, it is not good economy in that country to construct even the distributing canals and other small sub-

* This general smoothness of surface is one of the reasons why the rain-water is more rapidly discharged from it, and consequently why floods are more sudden and destructive in many parts of Europe than in otherwise similar regions of the United States.

† On the Alps, irrigation is practiced almost up to the limit of perpetual frost. The water of melting snow, low as is its temperature, is conducted immediately over the grass, and, in fact, observing farmers in New England have noticed that the pasture-herbage on the borders of a snow-bank which has remained partially unthawed until late in the spring is particularly green and luxuriant. The mountaineers of Switzerland and of Italy have been compelled to exercise much ingenuity and industry in removing small accidents of surface, and adapting their canals to the thousand larger curves of Alpine pastures and meadows, and they contrive to obtain, by watering, good crops of hay on slopes so steep that the laborers—chiefly women, I am sorry to say—cannot stand upon them without being supported by ropes from above, or at least wearing iron *crampons*, or creepers, on their shoes. Cutting the hay in such meadows is one of the greatest dangers of Alpine peasant life. In a small commune on the Italian side of the mountains, with a population of a thousand souls, I counted, ten years ago, more than sixty small wooden crosses deposited in a couple of niches in the rock, as memorials of that number of persons who had lost their lives in the commune by accident since the year 1840. Most of the deaths were from slipping in cutting hay on slopes overhanging precipices or torrents, though there were several from falling from trees while picking the leaves to be dried and used to eke out the slender supply of winter fodder for the cows. Grass ground bears a high price in the Alps; good meadow-land, with water, selling readily at from one to two hundred dollars an acre.

sidiary works, except where at least four inches of water per week can be secured for the whole irrigated surface. This point is important as showing the danger of entering into the system without previous careful inquiry as to the sufficiency of the supply, and this again involves the necessity of experiment sufficiently varied and long-continued to determine what, in a given climate and with a given system of agriculture, is a sufficient supply.* But I shall return to this point hereafter.

26. There is another suggestion which it is proper to make in estimating the economical value of irrigation, namely, the fact, that in some parts of our own country production is now overabundant, that it needs rather to be repressed than enlarged. When the market-price of Indian corn is less than the cost of its transportation to the seaboard, and growers can turn it to no better account than to burn half of it for fuel for distilling the rest, it is evident that the money it costs to raise the surplus yield might be more advantageously spent in creating new facilities for conveying the grain to consumers who require it for higher uses than in making expensive arrangements for increasing crops which are already so luxuriant as to be a burden rather than a blessing.†

27. From all this it will be obvious that considerable evils necessarily attend the practice of field-irrigation, and that these would be sensibly felt in its introduction into a country which, taken as a whole, stands in no special need of such a resource for increasing its agricultural production, which has, near its plow-lands and its meadows, no reservoir of Alpine snows to serve as a perpetual source of supply for canals of irrigation, and indeed, though with some important exceptions, no peculiar geographical or climatic adaptation to the system.

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* The quantities of water applied to growing crops in Europe are always large, and the statements of some professional writers on this point seem almost incredible. According to Boussingault, meadows require in Germany a supply equal to eight and a half inches per week, the water being admitted from twenty-five to thirty times in the course of the season. Puvis makes a similar computation for France, and thinks double this quantity would not be too much.—BOUSSINGAULT, *Économie rurale*, vol. ii, p. 246.

The measurements of Hervé Mangon, a very high authority, give in general considerably larger amounts, and it is singular that in the mountainous and comparatively cold department of the Vosges, much more water is applied than in the warm climate of Southern France. Thus, in one meadow examined by him, the water flowed over the soil during eleven hundred and seventy-eight hours, divided into eight periods, between the 23d of November and 11th of August, and the quantity applied was equal to about 27 feet, or seven or eight times the usual rain-fall for the whole year. In another case, to use his own words, he found that the quantity applied in one year "would cover the soil with a stratum of water about thirteen hundred feet deep," or about an average of three feet and six-tenths per day through the year. The soil thus received daily a quantity of water equal to the whole annual rain-fall. In these cases, irrigation was continued through the winter.—M. HERVÉ MANGON, *Expériences sur l'emploi des eaux dans les irrigations*, 2d edition. Paris, 1869.

†A hundred years ago France grew more wheat than could be consumed in bread, cakes, and pastry at the tables of the rich; the poor, who lived on black bread, using of course no wheat-flour. Fashion furnished a means of disposing of the surplus grain by converting it into articles employed in personal decoration. It is a well-attested fact that at the period I speak of, the pecuniary value of the products of the starch-factories which supplied the polite world with hair-powder also, was thrice as great as that of the paper manufactured in France, and the French nation "expended in soiling the heads of a few with powder" 33 per cent. more than for soap to cleanse the person and the linen of the whole population.—PASSY, *Les machines*, p. 148.

The monstrous frills, ruffs, and ruffles, then worn by both sexes, occasioned the consumption of much more starch than is required for the plain linen now used by gentlemen, and the substitution of a larger proportion of silk for vegetable tissues in ladies' attire has greatly reduced the demand for starch for their habiliments.

Hair-powder, which, in the last century, was essential to full dress, is again coming into vogue, and the omnipotence of Parisian fashion may restore to starch its ancient dignity and importance. Hence a revolution in the costume of our "upper ten" may perhaps hereafter relieve in some slight degree the bursting granaries of our western corn-growers by applying their contents to new or rather enlarged uses.

VI.—ADVANTAGES OF IRRIGATION.

28. But my object in pointing out these evils with something of detail has been to inculcate the necessity of caution in attempting a great and general revolution in our agricultural methods, and by no means to discourage careful study of the subject or judicious experiment in appropriate localities. On the contrary, I am well aware that there are extensive territories in our domain where permanently remunerative agriculture is impracticable without irrigation, and indeed I am convinced that there is scarcely any part of our soil where it may not be, at least occasionally, employed with great advantage.

29. The force of the objections I have stated depends much on the physical conditions of the region in which irrigation is employed, and there are whole counties in many of our Eastern States where they have little or no application; while in other localities they may, by judicious legislative and economic measures, be almost wholly obviated, and in still others abundantly compensated.

30. Thus, in elevated and mountainous districts, water is usually abundant, and its sources so numerous that almost any land-holder may secure one or more of them for his own sole use, without clashing with the rights and interests of his neighbor. Hence the division of the soil into comparatively small estates is promoted; for though, in new countries like ours, mountain-lands are thinly inhabited and held in large tracts, yet well-watered hill-pastures gradually rise in value, and these at last become the homes of a comparatively dense population, each of whom is the lord—not of square miles, indeed, but—of acres of productive soil.

31. In such territories, irrigation does not injuriously affect the health of the population. Malarious influences are exerted not by flowing or even by freely-percolating water. It is only when the fluid stagnates on the surface, or in the soil, that it becomes pernicious. In the hills, the inclination promotes the swift flow of water over the ground, or along the canals, and its descent by infiltration is also too rapid to admit it to become a cause of vegetable putrescence. In Central and Southern Europe, almost all the surface of the mountains which has not been swept away by torrents is irrigated through the summer; but fevers and other malarious diseases do not occur in those regions, and they are regarded by many European physicians as especially salubrious even for persons affected with pulmonary complaints.

32. The beneficial effects of irrigation in mountainous countries are not confined solely to the watering of the crops. It checks the too rapid flow of the waters of precipitation, and thus exerts an important geographical, if not climatic, influence. A large proportion of the water permitted to spread over the surface, and meander along the canals in the upland meadows and pastures, is absorbed by the earth and slowly filtered down, refreshing the roots of the plants it encounters in its passage, until at a somewhat lower level it bursts out in the form of springs. It is a familiar observation in all the older American States that the hills are growing constantly drier and the herbage less abundant, and that the springs which formerly supplied this stock are disappearing.* The principal cause of this disastrous change is undoubtedly

* I shall not attempt to say whether there is any sufficient reason to believe that, from unknown causes, vast territories, and even whole continents, are permanently losing their supply of water, but the process of gradual desiccation which follows the destruction of the forests certainly goes on for generations, and not improbably for centuries. Hence we may suppose that, unless a remedy is applied, the uplands in all our Atlantic States will grow more and more arid and barren, and finally become as waste as the most parched and naked mountain-ridges of Central and Southern Europe.

the destruction of the forests which once clothed the crest of every mountain, and which, it is earnestly to be hoped, will soon be at least partially restored. The replanting of the woods is a slow process, and the continued drying-up of the soil is every day rendering it more and more difficult. In the mean time, the introduction of a general system of irrigation at the highest levels where water can still be found, aided by the excavation of simple reservoirs on the hill-tops, and at other higher points for retaining the water of rains and melting snows until it can be applied to the surface by canals or absorbed by the earth, would do very much to retard the unfavorable change which is now taking place in the water-supply of our mountain-farms, and would, at the same time, greatly augment the product of our grass-grounds, and often of our plow-lands.

33. It has been observed in Europe that draining the soil, either by surface or by underground conduits, tends to increase the suddenness and violence of inundations by promoting a too rapid discharge of the waters into river-channels. Irrigation in the mountains, or even on the plains, has the contrary effect by retaining much of the water until it can be returned to the atmosphere in the form of vapor. Draining then deranges the harmony of nature by interfering with her methods of maintaining a regular interchange and circulation of humidity between the atmosphere, the earth, and the sea. Irrigation is in effect a partial return to the economy of our great material parent by regulating that circulation in a manner analogous to her primitive processes.

34. Where springs are numerous, as they usually are in hilly countries, only small and cheap canals, easily accommodated to the accidents of surface, are needed for the diversion of water from its natural channels, to flow over the surface of the ground or to moisten the roots of the grass by infiltration from the artificial water-courses. But the moderate extent and capacity of the necessary canals is not the only advantage of an inclined and undulating surface in the supply of water for the crops. Hilly and winding slopes admit of a simple and efficient mode of irrigation, or rather of a substitute for the practice which is not available on level soils. The method in question has been practiced with success in many parts of the United States, where it is known by the name of *circling*, and it is very highly recommended by all European writers. It consists in horizontally terracing the slopes or even simply furrowing them with the side-hill plow, and leaving the surface permanently in this condition. The rains and melting snow are arrested by the little platforms and ditches thus produced, and gradually sink into the ground instead of running off the surface, and thus supply sufficient moisture for vegetation. It has been found that even in the parched provinces of Southern France soils thus treated produce a vastly-increased amount of herbage or of other small crops, and this system, as has been observed in regard to ordinary methods of irrigation, has a collateral advantage of serious importance in countries subject to inundation. The water of precipitation, which soaks into the ground instead of rushing swiftly into the tributaries of great rivers and suddenly swelling them into raging floods, is retained long in the soil, and finally carried off by slow subterranean conduction, or restored to the atmosphere through absorption and exhalations by vegetables, or by direct evaporation from the surface, and thus equilibrium is restored.* In a large part of our territory, then, and especially in that

*A somewhat more complicated, but much more efficient, system of circling than that referred to in the text was invented and introduced into Tuscany with great advantage early in this

best suited to the important branch of dairy husbandry, irrigation would not only be unattended with many of the evils which are in some degree inseparable from it on soils of a champaign-configuration, but might be introduced at a very moderate cost, and probably with very beneficial results to our agricultural and other social interests.

VII.—DUTIES OF GOVERNMENT ON THIS SUBJECT.

35. The expediency of resorting to irrigation as a *general* and regular feature of our entire system of rural husbandry is a much more complex and difficult question. Of course, I do not now refer to the agriculture of the comparatively-rainless zones of our territory, where all cultivation is impracticable without the artificial application of water to growing crops. But even there, urgent as is the necessity of immediate provision for at least a temporary supply of water to lands lately brought, or now about to be brought, under cultivation, there is even greater need of caution and circumspection in the construction of permanent works for the diversion of springs and rivers from their natural channels, and it ought to be the first care of the governments of those territories to see that private individuals or associations do not acquire title by hasty grant or prescriptive rights, by appropriating to their own exclusive use the scanty supply which nature designed for the common benefit of all.

36. The duties of the general and the local governments of the United States in regard to the branch of rural economy we are discussing are by no means confined to the simple protection of natural waters from private encroachment. In the general unfamiliarity of our people with this important subject, we must look to our rulers, both for information on its practical and economical aspects, and for such legislation as shall prevent the greatest amount of evil and secure the greatest amount of good from the introduction of a system so new to us, and which, like all attempts to appropriate to the use of individuals gifts of nature which have long been common to all, must clash with many rooted prejudices, many established customs, and many supposed indefeasible rights.

37. Government ought, then, to take steps for collecting and diffusing the existing knowledge on this subject, and where that knowledge is deficient, to supplement it by encouraging and aiding experiment, and by special inquiry into the physical condition and capabilities, the wants and the means, of all our territory where the direct natural supply of water from the heavens is insufficient in quantity or too irregular in distribution, to satisfy the needs of cultivated vegetation.

38. Much of the practical information needed may be gathered from European experience, and from the study of the methods now employed in those exceptional parts of our territory where irrigation has been long practiced. But the climate and other physical conditions of most of our States, and many of the crops best suited to their soil and sky, are so different from those of the irrigated countries I refer to, that much experiment is needed in order to adapt the fruits of that experience and the application of those methods to soils and crops hitherto cultivated by simpler and more familiar processes. Private experiment in favorable localities may, and doubtless will, do much to throw light on this subject, but the knowledge thus gained will be too local and too special to be of much general value, and we need some easily accessible

century by Testaferrata, a peasant employed as a farm-manager by the Ridolfi family. I cannot here go into details, but a description of the method will be found in COSIMO RIDOLFI, *Lezioni Orali di Agraria*, vol. ii, 460 and the following pages.

preliminary source of instruction to serve as a guide and a safeguard to private enterprise. This can scarcely be furnished, except by either the Federal or State governments, and, in fact, important contributions to our knowledge on this subject have already been published and widely circulated in the reports of the Department of Agriculture at Washington. But what seems to be specially wanted is a series of brief reports of experiments deliberately made by persons of known competence, under Government patronage or sanction, in each geographical section of our country having marked peculiarities of climate, soil, and adaptability to special culture.

39. Such experiments would embrace the investigation of the best methods and seasons of administering water to different crops, and of the quantities required for each; the increase in the quantity of the product from irrigation, as ascertained by actual comparison with similar crops grown without water, but otherwise under similar conditions; the relative quality of watered and unwatered vegetables in point of flavor and of nutritive properties, as well as of richness in saccharine matter, vinous juices, or other important constituents—and this, as I have already observed, has not been sufficiently investigated in Europe; the relative rapidity and period of growth and ripening of watered and unwatered crops; liability to disease or attack by insects; adaptation for drying or other modes of preservation; effect of watering the soil as to danger of injury by frost; accurate computation of the relative cost of cultivation with and without water; and other points which would naturally suggest themselves to experimenters seeking for knowledge rather than for immediate profit.

40. These experiments would not include the construction of great canals of *diversion*, which, as we shall see, ought to be provided for in another way; though the simplest and most economical subsidiary works for the *distribution* of the water should form a subject of investigation.

41. But experiments of this sort would be of comparatively little value unless accompanied, if not preceded, by a hydrographical survey of all the territory which requires or admits of irrigation for agricultural purposes. Even in Italy, where irrigation has been largely practiced for thousands of years, Castellani thought, in the time of the first Napoleon, that such a survey was not only a necessary preliminary to all improvement and all new legislation on the subject, but was indispensable even to the maintenance of the existing system. Such a survey would embrace the quantity of water which can be furnished by the lakes and rivers of each hydrographical basin; the possibility of augmenting the supply by diversion of currents from localities where no agricultural application of them is practicable, or where the supply is in excess of the demand, by artesian borings, common wells, or reservoirs for retaining flood-water and melting snow; the ordinary temperature—a point of very great importance; mineral constituents, and quantity and quality of the sedimentary matter of each source;* the probable effects of the

* Although, as I have stated in the text, the glacial waters of the Alps are applied to grass-grounds with advantage, yet to many cultivated vegetables water of a low temperature is positively injurious, and there is probably no case of a tilled crop where, other things being equal, the value of water is not directly proportional to its warmth. The cold current of the Dora Baltea proved almost destructive to the harvests in the rice-fields of Piedmont to which it was conducted.

In most parts of the United States, the water of natural springs and rivulets does not contain ingredients hurtful to vegetation. But in mining and in volcanic regions, as for example in Sicily, the water of such sources is often poisonous to plants. Hence, the currents which rise in the Sierra Nevada and other western mountain-chains may be found both too cold, at least in elevated districts, for any crops but grass, and too heavily charged with mineral constituents to be of any value for irrigation.

diversion of currents from their natural channels, as respects the supply for existing or necessary hydraulic works for mechanical purposes, for aqueducts for great cities, for rivulets, springs and wells, at lower levels by infiltration and percolation from river-beds; and the best points for the construction of reservoirs and canals of diversion.

42. Such a survey, or at least something approximate, is an indispensable basis for all sound legislation on the subject; and it will be found, I doubt not, in America, as it has been in most European countries, that the first article of the water-code should be a declaration that all lakes, rivers, and natural water-courses are the inalienable property of the State, and that no diversion of water from its natural channels is lawful without the permission of the public authorities. Very probably constitutional amendments would be necessary before such a declaration could be effectual; and independently of this, vested rights, for which compensation ought to be made, may in many cases have been acquired by legislative grant or by prescription. Perpetual concessions of water-rights to individuals or to corporations, or even grants for more than a very limited number of years, ought to be forbidden by constitutional provision, both on general principles of legislation, and because, in consequence of the change of volume in water-courses from the destruction of forests and from other causes, and of the varying numbers and wants of the population, a grant, which at a given period was unobjectionable, may become highly injurious to the public interests ten years later.

43. Not only the natural water-courses, but the principal reservoirs and canals also, ought to belong to the State and be always administered by it. Such works will seldom be properly and securely constructed by private persons or bodies, and the management of them by individuals, and especially by corporations, will always be liable to abuse and gross corruption. No irrigation-works, in fact, except for the distribution of water over private grounds, after it has once been withdrawn, under Government supervision, from Government sources of supply, ought to be intrusted to private hands.

44. There are, no doubt, serious objections to the assumption of such burdens and such responsibilities by republican governments, but there are also graver and, as I think, insuperable objections to any other system. Financially, at least, public operations of this sort, if not too precipitately undertaken, might, and probably would, be highly advantageous. The truly stupendous net-work of canals lately constructed in India by the British government, taken as a whole, yields a fair rate of interest, and some of the more important branches return annually more than 20 per cent. on their entire cost. The government irrigation-works in Italy and France, too, have been found highly remunerative as a direct investment. But the financial profits of such works are not by any means to be measured by the income from the rent of the water alone. The vastly-increased production from irrigated lands, by enriching individuals and promoting the general prosperity, furnishes a greatly-enlarged base for taxation, and in this, as in most other cases, the best and securest revenue of a State is that which goes to fill the pockets of its citizens. The canal Cavour, lately constructed in Piedmont, and which, it was computed, would water not far from 300,000 acres, was undertaken by a corporation composed, in large proportion, of English stockholders. The managers proved as dexterous financiers as those of the most successful American "rings" and Crédits Mobiliers, and the result was that, though the speculators made fortunes, the shareholders had sunk their capital before the work was completed. The Italian government was obliged to interfere, and finally purchased

the canal; and there is no doubt that it will prove very profitable as an immediate investment, and still more so as an indirect source of income, from the increased wealth of the community.

The details of administrative legislation on the subject of water-supply will be found full of difficulty, and experience will doubtless show the necessity of frequent amendment of even the most carefully-considered codes which may be adopted. In legislating on a subject so new to us, we cannot expect to give in a day a satisfactory solution to problems which, after centuries of experience, have not yet been fully mastered by the wisdom of the philosophers and lawgivers of Europe. Still, in spite of the difficulty of reconciling American institutions and habits with many of the legal provisions applicable to the material and social conditions of the Old World, I imagine that this branch of European jurisprudence is as well worthy of study and imitation among us as foreign methods of practical irrigation. The literature of European legislation, customary law, and judicial action on this subject is voluminous enough to form a library of itself, and in latter years much has been done to lighten the labor of research on water-questions, and to facilitate the application of the law by legislative codification as well as by the compilation of digests and compends by private jurists.* The study of such works, many of which, no doubt, are to be found in the library of the Department of Agriculture, at Washington, would be an almost indispensable preparation for drawing up a code of water-law, and would prevent many errors of legislation, both in principle and detail.

45. It is evident that, for constitutional and other obvious reasons, little of the legislation on this subject properly belongs to the Federal Government, though Congress might take measures to prevent dangerous interference with the natural drainage of what remains of the public lands of the nation, and the acquisition of vested rights in the waters of these lands, as well as generally in the Territories. This might be done either by a general declaration of the right of the nation to the property of such waters, subject to alienation only in favor of State governments, or by special reservation in all land-grants in districts where irrigation is, or is likely to become, important. But the regulation and administration of the general water-supply, the special legislation respecting use, and against abuse, in the distribution of water, and the prevention of such modes of applying or discharging it as may be injurious to health or to a proper fluid circulation in the territory, must belong to the State governments, which alone can possess the local knowledge necessary to guide the law-making power.

46. In States where irrigation has an actual or a prospective importance as a general agricultural process, the Government ought—

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* Among the most recent and most comprehensive of these is CALANDRA, *Manuale Idraulico Legale*, Savigliano, 1870, 1 vol., 12mo, 547 pp. I recommend also an unpretending pamphlet by the eminent geographer, Cristoforo Negri, under the title *Idee elementari per una Legge in Materia di Acque*, Torino, 1864. Other works of value are: R. BAIRD SMITH, *Italian Irrigation*, 2d edition, London, 1855, 2 vols., 8vo, and atlas; C. C. SCOTT MONCRIEFF, *Irrigation in Southern Europe*, London, 1868, 1 vol, 8vo; A. VIGNOTTI, *Des irrigations du Piémont et de la Lombardie*, Paris, 1863, 12mo, pamphlet; P. CUPPARI, *Manuale del Agricoltore*, Firenze, 1870, 1 vol., 12mo; G. TOGLIASECCHI, *Canali dell'alta Lombardia*, Milano, 1872, 8vo, pamphlet; N. BEARDMORE, *Manual of Hydrology, with Hydraulic and other Tables*, London, 1862, 1 vol., 8vo; A. DUMONT, *Des travaux publics dans leurs rapports avec l'agriculture*, Paris, 1848, 1 vol., 8vo; M. G. DE PASSY, *Étude sur le service hydraulique*, Paris, 1868, 1 vol., 8 vo; and especially the works of Nadault de Buffon, on irrigation and general agriculture. All the writings of the eminent engineer Lombardini, of Milan, are of great value; and it is impossible to acquire a fair knowledge of the hydraulic system of Upper Italy without a study of them. They are numerous, and for the most part published in the form of contributions to scientific periodicals; but many of them have been separately printed.

To assume the absolute and perpetual ownership of all natural waters except small lakelets and springs or rivulets of a volume barely sufficient for the irrigation of private estates of moderate extent in which they lie or rise;

To provide for a complete hydrographical survey, and, as fast as the necessary information is required and the need of such works is felt, to proceed to the construction of canals of diversion, reservoirs, and feeders, which, like natural rivers and lakes, shall remain forever the property of the State;

To secure the permanence of the springs and streamlets which feed the rivers and the lakes by prohibiting the destruction of the forests around them, and by the plantation of woods in suitable localities, as well as by other available measures;

To prohibit the cultivation of rice or other aquatic crops, and the retting of hemp or other vegetables, except in isolated localities remote from human habitation and routes of travel;

To provide for the drainage or filling up of malarious swamps, and to establish regulations respecting the discharge of water flowing from or over irrigated lands so that it shall not injure lower grounds, or stagnate in or on the soil to the prejudice of the public health;

To prescribe the mode of withdrawal of water from the public sources by canals of distribution for private use, and to determine the method of measurement of the quantity withdrawn;

To make rules for fixing the rates of compensation to the State for the use of the water, and to establish local boards or tribunals, with power to assign the volume and seasons of distribution to the respective landholders within the precincts of the source; and

To provide that, in proper cases and on equitable terms, the owners or occupants of lands not bordering on public waters shall have a right of passage over lands lying contiguous to such waters for constructing and maintaining canals across them, and of using waste water flowing or percolating from grounds at a higher level.

47. These are the principal points to which the attention of the legislature should be directed; and it is obvious that, with our vast variety of soil, climate, crops, and geographical surface, no system can be devised which would be universally applicable. Every State must frame a code suited to the physical and social conditions of its own territory; and even without those limits, exceptional provisions adapted to special localities or branches of agricultural industry will often be requisite.

48. Next to the sanitary regulations, I have no doubt that the leading feature of special State legislation on this subject should be provisions not merely for securing the rights of small landholders, but for encouraging the division of the soil into estates or farms of relatively narrow extent. This may be accomplished, in part at least, by conferring upon such landholders the privilege of withdrawing a larger proportion of water, or of using it at a lower rate of compensation than that allowed to great proprietors; and further encouragement might advantageously be granted to poorer occupants who build and inhabit houses upon these lands. The Moors introduced into their Spanish provinces practical methods of irrigation, and the Spaniards, a people to whom we do not habitually look for instruction in jurisprudence, have built up on the rude foundation of Moorish water-law a hydraulic code, framed with special reference to this end. A large proportion of the Spanish peninsula is divided into small parcels and cultivated very successfully under this system. Many of the provisions of the Moorish law are still in force in the provinces they occupied, and in some places local tribunals, first

instituted by the Moors, having exclusive jurisdiction of water-questions, still exist and hold daily sessions during the season of irrigation, for summarily trying and deciding, without appeal, all controversies arising within their precincts respecting water-rights.*

VIII.—ARTIFICIAL METHODS OF OBTAINING WATER.

49. There are many localities where an adequate supply of water for household purposes and for irrigation may be obtained by simple methods without resorting to running streams or other public waters. Much land in Italy, Spain, and other countries is irrigated with water drawn from common wells by cheap machinery worked by horse-power; artesian and tubular wells are also largely employed for the same purpose; and copious springs may often be reached by driving short tunnels into hill-sides.† Another excellent method, practiced with much success in France, is that of conducting the rain and snow water from hollow slopes of grass-ground of a considerable surface into cisterns, or into filtering receptacles, consisting merely of a relatively small extent of sand or porous earth laid over a pavement or bed of clay some four or five feet below the surface. In this way, a large proportion of the precipitation received by the slope is retained, and perennial springs are formed at a less expense than is very frequently incurred in conducting water from only a moderate distance.‡ Contributions of this sort deserve encouragement, because they render the farmer independent both of his neighbor and of the public; and even if the first cost of the works is somewhat greater than that of a canal from some source not his own, he will generally be, on the whole, a gainer by procuring a supply absolutely at his control.

IX.—IMPROVING LAND AND RAISING ITS SURFACE BY FLOODING.

51. I have thus far used the term irrigation in its common and only proper sense, which is the artificial supplying of ordinary water to growing crops. Pure water is a constituent of all vegetable substances, and it also serves as a solvent for other elements of growth, and as a medium

*On irrigation in Spain, see JAUBERT, DE PASSÉE, *Voyage en Espagne*. 1819 M. AYMARD, *Irrigations du midi de l'Espagne*, Paris, 1864, 1 vol., 8vo, and atlas; C. R. MARKHAM, *On Spanish Irrigation*, London, 1 vol., 8vo., 1867, and works therein cited.

† In Persia, tunnels for this purpose, of incredible length and very simple construction, are frequently excavated. Chardin describes these tunnels in the fourth volume of the Paris edition of his travels, 1811, and states that they are carried to a distance of twenty or thirty miles, and sometimes much more. This would be almost beyond belief, were not Chardin's accounts confirmed by the recent testimony of Colonel Chesney. On sloping grounds in Lombardy, which receive a subterranean supply by infiltration from mountain lakes and streams, water is cheaply obtained by what are called *fontanili*. These are small reservoirs, excavated to a moderate depth, and connected by open ditches extending up the slope to small springs, whose water is collected in barrels sunk in the ground to receive it, and if the supply is insufficient, the water from several small sources, aided perhaps by an artesian well of little depth, is united, and the whole conducted to a common receptacle. See VIGNOTTI, *Des irrigations du Piémont et de la Lombardie*, 1863; and J. B DENTON, *On Water-Supply to Villages and Farms*, London, 1865, pamphlet. It must be observed, as an important fact, but recently brought into notice, that river-water, especially in time of flood, is vastly more fertilizing than spring or even rain water. The temperature, too, is a matter of much consequence; and ground-water, however obtained, ought to be exposed to the sun and air in cisterns or reservoirs long enough to become warm before using it for irrigation.

‡ Some years since. Dumas, a French engineer, proposed a method of economizing the water f precipitation—more than three-quarters of which usually run to waste—by a general system of circling, ditching, reservoirs, and cisterns The plan of Dumas is materially, and in many situations doubtless economically, feasible, and might be extended over large areas with advantage. In any event, his work, *La science des fontaines*, Paris, 1857, 1 vol., 8vo, which is full of valuable suggestions, is well worth perusal.

for introducing them through the roots into the tissues of plants. It is usually chiefly with reference to these functions of water that means are employed for bringing it within reach of the organs of vegetable nutrition. But water is never found chemically pure, and the current of the most limpid spring always contains more or less foreign matter in a gaseous or solid state. This matter generally possesses fertilizing properties, and it consequently both immediately promotes the growth of the plants to which it is applied and enriches the soil, by depositing on or in it extraneous matter not at once taken up by the absorbent action of the plants. This latter advantage is merely incidental, and is never the direct object of what is appropriately called irrigation. But, for want of a proper specific word in our English vocabulary, the term irrigation is sometimes applied to a practice the object of which is not to promote the growth of a single annual or biennial crop, but to enrich permanently the ground to which it is applied, by exposing it to the action of water abounding in the gaseous, the organic, and the mineral elements of vegetable life, and by depositing on its surface a layer of fertile sedimentary matter, and often, at the same time, to raise considerably the level of the ground. This practice has been extensively and most advantageously employed on the shores of Holland and the adjacent states, as well as in England, and even on our own coast. In these instances the water is salt, and is supplied by the tides of the sea. But a similar application of fresh water has long been known, and it has wrought real geographical revolutions in Italy and elsewhere, by filling up malarious marshes and other low grounds, and thus at once creating an arable soil and cutting off a dangerous source of fatal disease. In fact, common river-meadows, intervales or bottoms, and even vast alluvial plains, as in Egypt, in Assyria, and in Lombardy, which are generally of extraordinary fertility, have been formed by a natural process of this sort, and thus destructive floods, which along the swift tributaries of rivers wash away much valuable soil, make some amends by spreading it out again in broad expanses. It is but lately that anything important has been done in the United States in the way of artificial contrivance for thus utilizing the water of river-floods, and compelling it by dikes and canals to deposit its precious freight at the will and for the convenience of man; but the subject is attracting great attention in Europe,* and we in America are beginning to realize the immense benefits which may be derived from a judicious imitation of this as well as other spontaneous processes of nature. This method of physical improvement is attended with few or none of the evils which are almost inseparable from ordinary irrigation, and it has the important advantage of exercising a beneficial rather than an injurious sanitary action. There is reason to believe that the leveling up of swamps and other low grounds, by retaining on them flood-water long enough to allow it to deposit its sediment, and especially by employing upland streams to wash away waste earth and spread it over

*A popular treatise, by MILLET, *Les merveilles des fleuves et des ruisseaux*, Paris, 1871, contains many most interesting facts in reference to the very great value of flooding land with river-water, as a means of permanently enriching it. Among these are observations on the powerful fertilizing action of carbonic acid and other gases, carbonates, silicates, and phosphates, and other mineral substances contained in the flood-water of rivers, and the statement that at a winter temperature of from 32°+ to 43°+ Fahrenheit, both ligneous and herbaceous vegetables will bear submersion for a considerable time without any injurious consequences to their organism, and consequently this method of fertilization may often be resorted to without the loss of a single crop. See, also, HERVE MANGON, *Expérience sur l'emploi de l'eau dans les irrigations*. Perhaps the best source of information on the subject of submersion of land, however, is NADAULT DE BUFFON, *Hydrologie agricole*, Paris, 1867, 1 vol., 8vo, and atlas.

morasses and other depressions of surface, would rescue for cultivation and habitation much unproductive and unhealthy soil. Few modes of amelioration of natural conditions are better worthy of public patronage and encouragement, or at least of experiment, than this.*

52. The limits of space to which this communication is necessarily restricted have obliged me to content myself with a very superficial view of this important subject, and I cannot enter here at all into financial statistics or other material details. I am, however, thoroughly convinced, after much observation and inquiry, that irrigation may be immensely extended among us with great economical advantage, and that, by reasonable prudence, and above all by a sufficient exercise of moral courage by our rulers, nearly all the evils which ordinarily attend the practice may be avoided, or at least greatly mitigated. We are in a position to protect ourselves and our posterity by, if I may use so hard a word, *prophylactic* measures—to supply the remedy before the disease manifests itself; whereas, in the Old World, irrigation had become a widely-spread and deeply-rooted agricultural method before its mischiefs were appreciated or even suspected, and a preventive policy came too late. European legislation has always been necessarily directed mainly to the combating or compensating of already-existing evils. Ours, by wise precautions, may prevent their occurrence. As I have already said, ample means of information respecting European usage and legislation exist, and the volumes I have specially referred to, though by no means exhaustive, will at least serve as useful introductions to the study of agricultural hydrology.

In a new edition of my "Man and Nature," now in course of publication at New York, I have discussed with comparative fullness many of the points here barely touched upon; and to that work, and the authorities cited in it, I take the liberty to refer the reader.

DIGEST OF STATE REPORTS.

INDIANA.

The twenty-third annual report of the Indiana State Board of Agriculture for 1873 contains the transactions of the board for the year named, and the proceedings of the January meeting for 1874. The work contains, as a frontispiece, a plate of the State fair and exposition buildings at Indianapolis, which were erected at a cost of over $100,000. The lands and buildings now owned by the society are valued at over $300,000. The report also contains a lithographic map, by counties, showing the location and extent of the recently-discovered block-coal measures of the State.

The advancement and improvement of agriculture in the State during the past year has been very encouraging. At the last State fair every department was well filled, and the articles exhibited were generally of the highest order of excellence. The live-stock department was especially noticeable for the large display of grades and thorough-breds, and gave abundant evidence of rapid improvement in farm-animals. Re-

*On this subject see the remarkable works of A. DUPONCHEL, *Avant projet pour la création d'un sol fertile*, Montpelier, 1861, 8vo, pamphlet; and *Traité d'hydraulique et de géologie agricole*, Paris, 1868, 8vo.

ports from district and county societies show these local organizations to be in a more flourishing and prosperous condition than usual.

President Sutherland, in his annual address before the board, congratulates its members on the fact that the past year has been one of unusual prosperity to the people of the State. He thought it might be truthfully said of them that they possessed within their borders as many of the necessaries, for the sustenance of life for man and beast, as any State in the Union. Referring to the survey made by Professor Cox, State geologist, the president says that the rapid development of seemingly inexhaustible beds of block-coal of the best quality, which needs no coking for the smelting of iron, of the rich iron-ore and boundless quantities of superior stone which have been discovered in various sections of the State, are causing a steady inflow of population from every quarter of the globe. Every railroad in the State is engaged largely in freighting these products. There is no one thing which has occurred since the formation of the State that has done more toward increasing its population and wealth than this survey.

The secretary complains of the negligence of the managers of local societies in sending in their reports, and says the tardiness on the part of the officers of these associations renders the compilation of statistical information relating to agricultural productions an impossibility within the year in which they are produced. He advises a uniform day throughout the State for the election of officers of all county and district societies. At present the time of such election ranges from September until the following May, and frequently is the occasion of great trouble and delay in mailing matter for the societies.

Much space in the report is devoted to a description of the new exposition-building, and an account of the last State fair. The exposition-building was formally opened on September 10, 1873, in the presence of a vast concourse of people. Mr. John Sutherland, president of the State board, delivered the opening address. He was followed by Mr. James Mitchell, mayor of Indianapolis, Senator O. P. Morton, and Gov. Thomas A. Hendricks. Mr. Morton, in the course of his remarks, said:

This is a step out of the old beaten path of the ordinary State fairs. We have gotten beyond that; this must not be looked upon as a mere show—as an entertainment simply: on the contrary it is a school of knowledge, than which there can be no higher—no better. I insist that the money spent in an enterprise of this kind is as much devoted to the cause of education as money spent in the support of common schools. The farmer who comes here can see, in the course of three days, what improvements have been made in agricultural implements, and he can learn more in three days than he can learn on his farm in twenty-five years; and so with the mechanic. He comes to see what new tools and new improvements have been made in his trade, and he will carry away more new ideas with him, after a week spent here, than he would gain in his shop in twenty years. Therefore I say this is not a show, not a place of idle pastime; it it a school for the farmer, for the mechanic, for the business-man, and for all who are engaged in carrying on the commerce and business of this great country. You should therefore encourage it, and not look upon it as a means of amusement simply, but as a thing that is worth your time and money. * * *

Our material development is going on wonderfully. We have now nearly three thousand seven hundred miles of railroad in Indiana, not counting the side track, with four hundred miles under contract or in process of construction. Out of ninety-two counties in the State, you can go to-day by rail to eighty-seven; and in fifteen or eighteen months from this time you can go from Indianapolis to every county in Indiana by railroad.

We have vast mineral wealth, more valuable than the gold and silver mines of California, Colorado, or Nevada. We have six thousand five hundred square miles of coal-fields, and four hundred and fifty square miles of what is called block-coal, said to be the best in the United States, and equal to any in the world, for the making of iron. We have only recently discovered this great source of wealth to our State. It is an established fact that the block-coal of Indiana will make iron in its raw state without coking, equal to that of any other, and that pig-iron made from the Indiana block-coal is the best for making Bessemer steel; that is a point of great interest to our State, and upon which much depends in the future.

The bituminous coal of Pennsylvania, before being used in the manufacture of iron, must be coked or cooked in order to expel the bitumen, while the Indiana block-coal makes iron of equal quality in the raw State. The reason of this is, that this coal keeps its shape in the furnace; does not melt; does not swell and run together; leaves no cinder or clinker, and burns to a white-ash; is free from impurities, and it is said makes the best pig-iron for the manufacture of Bessemer steel in the world.

Speaking of the revolution likely to be produced by the use of block-coal in the manufacture of Bessemer steel, Mr. Morton said:

A word about Bessemer steel. It has a great future in this country, and is likely to produce almost a revolution in our railway system, and in many other things in which iron enters very largely. Professor Cox, of our own State, has submitted a calculation, verified by Prof. J. W. Foster, of Chicago, now dead, and by one of the ablest iron-masters in Pennsylvania, showing that Bessemer-steel rails can be made cheaper than iron rails by the use of the block-coal of Indiana. Bessemer-steel rails will last seven or eight times as long as iron ones. This becomes an important element in cheapening the construction of railroads, reducing the expense of keeping them up, and cheapening transportation. I believe the time will soon come when our existing railroads, east and west, will find it to their interest to put down double tracks, and lay their roads with steel rails. I have now in my possession a proposition from a distinguished business-man in Holland to build a railroad with four tracks from New York City west to some point in Ohio or Indiana, then two tracks diverging to Chicago, and two going to Saint Louis; those tracks to be laid with steel rails, and the road to be constructed in the most substantial manner, with private capital, and no aid asked from any State or from the General Government, the only condition of the proposition being that the road shall be chartered by Congress.

Of the importance of cheap transportation for the surplus products of Indiana, Senator Morton said:

As to transportation, let me refer you to a single fact, to show you the importance of cheap transportation to us as a State, and how it will affect the manufacture of iron and Bessemer steel hereafter. I have here a calculation made by a very careful gentleman, comparing the farm products of Pennsylvania and Indiana, as shown by the census of 1870. Pennsylvania had of domestic animals of all kinds, 4,006,589; Indiana had 4,511,094. Pennsylvania had grains to the amount of 60 460,000 bushels; Indiana had 79,350,454 bushels. The value of the farm-products of Pennsylvania was estimated to be $183,946,000; those of Indiana, $122,914,000. Thus you see that while Indiana had 505,000 head more of live-stock, and 19,000,000 bushels more of grain than Pennsylvania, yet the products of Pennsylvania are estimated at $183,946,000, on account of her greater proximity to market, while those of Indiana are estimated at $122,914,000. Thus you can understand the importance of cheap transportation to Indiana. Let us see how the question of transportation affects us on the other hand, with reference to the manufacture of Bessemer steel. Of the 174,000 tons of iron-ore used in the blast-furnaces of Pittsburgh last year, 84,000 tons came from Lake Superior; 64,000 tons from Iron Mountain, Missouri; 20,000 tons from Lake Champlain, and less than 5,000 tons from the home mines of Pennsylvania. They cannot manufacture their iron with the coal they have in Pennsylvania without coking it. We have coal in Indiana with which we can, in its raw state, make the best of iron, while we are two hundred and fifty miles nearer Lake Superior than Pittsburgh, and four hundred and thirty miles nearer to Iron Mountain, so that the question of transportation determines the fact that Indiana must become the great center for the manufacture of Bessemer steel. We cannot estimate the importance of that manufacture to our State.

The year is recorded as one of average prosperity to the farming community. The harvest, though not so abundant in some respects as in the preceding year, was more than sufficient to meet the wants of the people, leaving a fair surplus for export. The corn-crop of 1873 was not so good as that of 1872, as the yield averaged about ten bushels per acre less. The wheat crop, although of excellent quality, showed a small decrease in yield per acre as compared with the crop of 1872. The most notable difference in the products of the year, as compared with those of the preceding year, was in the smaller kinds of fruits, most of which are noted as failures. However, in some localities in the northern part of the State there were fair crops of most excellent quality.

The winter of 1872–'73 was of unusual severity, and continued so until late in the season. Cold rains extended far into May, and greatly retarded farm-operations. The summer was unusually pleasant, but there was an unprecedented rain-fall. The meteorological tables show that the

quantity of rain which fell during the season was equal to that which fell during the three preceding years.

The annual convention of the short-horn-breeders of the State was held in Indianapolis in May, and was attended by many of the leading stock-breeders of Indiana. Representatives were also in attendance from various sections of the country. The first paper read before the convention was on the subject of "the raising of calves and the management of milch-cows," by Mr. Charles Lowder. The writer advised the most careful treatment of calves, and said that upon the care bestowed upon them during the first year of their lives depended their size and value as neat cattle. Abuse and ill-treatment during the early life of the calf can never be overcome in subsequent years. The calf, when dropped, should be allowed to remain from twenty-four to forty-eight hours with the dam, unless some very extraordinary circumstances make it necessary to remove it. Calves will, in a majority of cases, get upon their feet and take the teats in due time; but if one should be too weak from any cause to be up within one or two hours after birth, some of the first milk or biestings should be drawn from the cow and given to it. If the cow should, from after-pain or mere indifference, fail to give it proper attention, the herdsman should have it well rubbed with a woolen cloth until dry, and its hair nicely laid by means of a camel-hair brush. After one or two days the calf should be removed from the cow and taken to the stall, where it should be tied fast by means of a leather strap around the neck, or with a head-halter made to fit, which is preferable. It should be allowed to suck the teat three times a day until about two weeks old, and should be led to and from the cow by the halter. If it has been well handled it will by this time be quite gentle and well broken. It may now be turned out so as to have fresh air, sunlight, and plenty of exercise. If a steer, and intended to be fed for the greatest possible profit for the shambles, this exercise is not necessary. In that case the more quiet and comfortable he can be kept, and the more highly fed, the greater will be the net profits. If the calf, whether male or female, is to be grown to maturity for breeding-purposes, the treatment should be quite different. In the first place the object is to develop the greatest possible amount of soft flesh and fat without any regard to the healthy development of the vital organs, as the heart, lungs, liver, &c. In the latter case due regard must be had for the uniform development and perfect health of every organ and part of the system. Without exercise the muscular part of the system of young and growing animals is not fully developed, and in the mature animal becomes enfeebled. The heart, being no exception to the law, becomes to some extent diseased, while the liver and kidneys share the same fate. With all the vital organs enfeebled, the animal is not prepared to withstand the sudden change of temperature to which it is sometimes exposed. As like tends to produce like, animals with diseased and enfeebled vital organs should not be selected to breed from.

Those engaged in rearing calves have several things to take into consideration. If the cow is an inferior beef-breed, the milk from her may be worth more to make into butter or cheese than to be given to the calf. In that case the calf should be sent to the butcher as soon as old enough to kill. But if the calf is of good beef-stock, and is to be raised to maturity for that purpose, or to breed from, it should be allowed to suck twice a day until four, five, or six months old. If an early-spring calf, it will learn to eat grass during the summer, and can be weaned in the fall without much, if any, loss of flesh. If a fall calf, it will soon learn to eat oats, hay, bran, or shelled corn, and as the grass starts in the spring it

can be weaned without any check to its growth, the grass answering the place of milk to some extent. When calves are allowed to suck twice a day, care should be taken that they do not get too much milk, as they may become sick, and fail to make as great gains as they would on a less quantity. In case of scours, a little chalk well powdered and placed in a trough, or in some place where it will attract their attention, will frequently be of good service to them.

Mr. Lowder says that calves intended for steers should be castrated when about two weeks old. The male calves that are to be reared and kept for breeding-purposes, should be removed from the females at one or two months old, and placed in a lot inclosed by a permanent fence, and should not be allowed to run with other cattle afterward. The heifers at one year old should be removed from all other cattle, and placed in a lot by themselves. At this age, if they have been well fed, they will express their desire for male company by a great deal of restlessness. If allowed to run with steers or older females they will be worried a great deal to no purpose. Heifers fifteen or eighteen months old are much more likely to get in calf than when they are kept from breeding until two or two and a half years old, especially if they are fed highly on grain, and are inclined to take on fat. The milking qualities of heifers depend much upon the kind and amount of food they receive while carrying their first calf. They should be in perfect health and in a thriving condition, and kept in full flesh until after calving. If they have been properly handled while calves, and up to the time when they are milked the first time, there will be no trouble in breaking them. The period of gestation is generally from 275 to 280 days, though some writers give the extremes from 240 to 321 days.

Dr. A. C. Stevenson read a paper on the "best method of keeping up and improving short-horns." As to the true color of short-horns he said:

The true color is in greater danger at this moment than any other quality. The short-horn color is red and white, or the two colors intermingled as in pied, or spots of red and white: or the matchless roan, found nowhere else. The red, the white, the white and red, and the roan. These colors are the most beautiful and showy belonging to any of the bovine varieties, and should not be changed, and cannot without damage to the variety.

On the improvement of short-horns he said:

The principles that control this question are few and simple, yet few practice them. This is manifest in the estimates placed upon those short-horn families that have been here a length of time. Fresh blood and new importation are everywhere sought. This presumptively shows that we are not even maintaining the quality of our short-horns. Are we always to be dependent on a foreign country for our short-horns? Have we no breeders here with knowledge to improve the short-horns, or even to maintain them in the state in which we have received them? There is no want of numbers here. They abound in every cattle-State in the Union. Hundreds of fine bulls are "trimmed" annually for the want of purchasers. And yet we are importing. With the finest climate, free from all cattle-disease, the most luxuriant grass and the most abundant cereals, all that could be desired to make the finest cattle, and yet the cry is, "fresh blood," "new importations." We say this is strong presumption that we have not maintained the short-horn blood; that we have not improved it.

And yet the principles that govern this are few and simple, requiring, however, patience and time. It is a well-understood and admitted fact that like begets like. The observance of this principle will maintain any variety of animals, either of horses, sheep, or cattle, with the other requisites of proper care and food. There is no need in a century's breeding of any deterioration, the surroundings being the same. There are constantly slight variations occurring in the best varieties of animals. In the human family we have frequent illustrations of this fact. Two persons cannot be found in any variety of the human family but may be distinguished one from the other; still the variety will be well marked and easily distinguished. There are family resemblances that are so strongly marked that they can be known as of certain families, still differences are observable. The rule is this—a specific sameness by which the species is readily distinguished. Species are again divided into varieties, alike distinguished by perceivable differences. One may be larger than the

other, one weak, another strong, another healthy, another otherwise; colors may differ, and yet the varieties are easily known. This law of animal-life is so important, as it relates to the question under consideration, that I will be excused for pressing it further. The parents of a family are often very much alike in some particulars, as in the color of the hair—both being black. The children will generally have hair of the same kind, yet it frequently occurs, from some unknown cause, that there may be a single one with red or light-colored hair. The parents may be dark-skinned, with a family of like color, yet there may be a fair one among them, as there frequently is. The parents may be large, still in a family there may be a small one or two. This law is found true to itself among the inferior animals. This is true of short-horns; one is red and another white. One may be large, another small, yet they are readily known as of the same variety. One is fine in the head, another bad. One has a fine-barreled body, a good heart, back, and loins, while another is defective, yet there is no difficulty in recognizing the variety to which they belong. Yet these facts do not vitiate the law that like begets like generally. The breeder, to maintain a breed, is safe if he breeds from animals equal in every respect If he desires to take a step forward he must do more—he must breed from better ones. But how are these to be obtained? By the occasional variations spoken of. There are none of the older breeders but have observed that there will come occasionally a calf much superior to others. Sometimes it will be superior in every respect—sometimes only in particular respects. Such are seized by the skilled breeder as a new or improved starting-point. A new family may be here commenced and continued; a like occurrence may happen in this family again and again. It is thus that improvements are made in all domestic animals. It may require time and patience and skill, but success is sure.

A discussion occurred on the subject of the milking qualities of short-horns, which was participated in by many of those present. Mr. Lowder said he had every quality of milkers, from the very poorest to the very best. He had four cows which gave one hundred and twenty-eight quarts of milk per day. One of them gave nearly fifty pounds per day, or over her own weight of milk per month. Her milk was not of the richest quality, but was very large in amount. Two of his poorest-looking cows were among the best for dairy purposes. Mr. H. C. Meredith believed there were some extraordinary milkers, and many good milkers among short-horns. As a rule they are superior in this respect. This breed has proven to be superior as cheese-makers. Mr. Thrasher spoke of a dairyman at Cincinnati who had experimented with cows of various breeds, and had decided that short-horns were superior to all others for this business. Dr. Stevenson said he did not desire any better milkers than the short-horns. The high price of these cattle was the reason they were not more generally used for dairy purposes. They are too expensive for the ordinary dairyman. Mr. Pentecost said the butter made from the milk of short-horns was better than that made from the milk of common cows. From one of his cows he drew one gallon of milk at each milking from one teat only. This cow was not the best butter-maker in his herd, however. Mr. O. S. Bliss, of Vermont, thought that the native cows of New England made as much butter as the short-horns, but the latter were better for beef. Jersey butter, in the Boston market, brought almost twice as much as the butter from other cows. But it was purely a matter of fancy, as one kind was as good as the other. Their best dairymen fed hay, roots, and shorts, with skimmed milk to calves, and on this feed could take them to the butcher at six months, and get good prices.

In regard to the proper time for fattening bullocks for the shambles, Messrs. Thrasher and Meredith preferred cattle three years old. Mr. Matthews thought that if calves were crowded with feed from the first they would sell well at two years old, and perhaps would be as profitable as if kept a year longer.

Mr. John Sutherland, president of the State board, in his address before the society, at the annual winter meeting, in January, 1874, alludes as follows to the first State fair held in the new exposition building:

I would recommend that the time of holding the fair and exposition should not exceed twenty days, for the following reasons: During the first ten days of the exposition 2,423

railroad and 21,652 gate tickets were sold, making 24,080; and for the next ten days, September 20 to 30, 5,952 railroad and 31,256 gate tickets; total 37,108. From October 1 to 10, railroad 23,666, gate tickets, 76,418; total, 100,008. And during the thirty days, railroad, 32,046, gate tickets 129,326; total 161,372. Thus you can see that three-fifths of all the tickets sold were sold during the last ten days of the fair. During those ten days, when we were about to receive a rich harvest, the money panic came upon us and diminished our receipts several thousand dollars. The first ten days of the fair the receipts from gate-tickets averaged $602 per day; for the next ten days, $930; for the last ten days, $2,502 per day.

GEORGIA.

The semi-annual convention of the Georgia State Agricultural Society was held at Stone Mountain, August 11, 12, and 13, 1874. The meeting was largely attended by members of the society and delegates from district, county, and other local associations. Mr. Alfred H. Colquitt, of Atlanta, president of the society, presided during the sessions of the convention. Messrs. John W. McCurdy and Milton A. Candler delivered brief addresses of welcome, which were appropriately responded to by the president. As an evidence of the progress of the society, Mr. Candler stated that the income of the first fair of the association, held in 1846, was but $50, while that of last year amounted to $30,000. The president, in his remarks, referred to some incidents in the early history of the society. It was organized in 1846. At that time the railroad had been completed from the seaboard to Oostanaula River, beyond Atlanta, then known as Marthasville. A Mr. Groves, having bought some land at this place, and desiring to attract attention to it, consulted Mr. Mark A. Cooper as to the best means of doing so. Mr. Cooper suggested the holding of an agricultural fair, to which the agriculturists of the State should be invited. An address was written and signed by many prominent citizens, calling upon the people of Georgia, Alabama, and Tennessee to meet and assist in the inauguration of the measure. The first name signed to the call was that of Mr. George W. Crawford, and the next that of Mr. Cooper. Then followed the names of Messrs. Asbury Hull, Charles McDonald, Charles Dougherty, Wilson Lumpkin, Thomas Foster, W. C. Daniel, and many others. The circular calling the meeting together was headed "Agricultural Fair and International Improvement Jubilee," and of all those signing this call but three were in attendance at the "jubilee." The entire premium-list amounted to less than $70. The live stock exhibited consisted of one large jack, owned by Mr. Groves. The fair was held in a blacksmith-shop, which was of sufficient dimensions to accommodate all the articles brought forward for exhibition and competition for the premiums. The second fair was held in a ten-pin alley, and the premium-list was increased to $108.

The society continued to grow in importance, and as early as 1851, at the fair held at Macon in that year, a premium-list amounting to $4,000 was offered and awarded to competitors in the various departments of the exhibition. The premium-list presented by the society this year amounted to $20,000. Speaking of the benefits which have resulted from the operations of this society, President Colquitt thus alludes to the great good it may accomplish in the future:

It is impossible to tell the vast amount of good that has been accomplished by the society in a moral point of view. Who can measure the progress of morals, of good temper, good manners, and hospitality in the past, directly traceable to the influence of this great society? And how much more of thought, good judgment, skill, and science has been brought into agriculture than before its organization? Before, if a man talked about phosphates, or sulphates, or phosphoric acid, or nitrates, &c., he would be laughed at and considered a fool. Now the commonest farmer talks as glibly about these as he used to talk about the commonest matter. He knows their properties and constituent elements in an astonishing

degree. What we now have to consider, and work to secure, is to get the application of this important knowledge properly applied on each plantation, and to be able to make and apply our own fertilizers scientifically. High-sounding names and appellations are given by the manufacturers of fertilizers to their products and constituent elements. Every one of those elements is to be found in cotton-seed and barn-yard manure. Planters have been carried away by names, and have wasted money, but we are learning, and are husbanding the results of investigations.

Profiting by the lessons learned through the instrumentality of this society, the people are this year doing better. Everywhere they are full of hope and confidence, and the present year gives augury of success more than at any time since the advent of the dark days of the past. I have traveled over nearly all of Georgia, and I am satisfied that, with a similar policy for next year and the years to come, we will be free and independent, and far on the high road to unbounded prosperity and happiness.

The president concluded his remarks by saying that a more diversified system of farming was being inaugurated by the people of the State; that more corn, oats, and wheat had been planted this year than in any one year of the last ten. It was highly probable that more corn would be produced than could be used within the limits of the State, and that instead of importing this article, as heretofore, the farmers would be able to supply, in a measure, their less fortunate neighbors of adjoining States. The indications were that some of the counties of the State would produce a supply sufficient to answer the home demand for two years to come.

Dr. E. M. Pendleton, in charge of the Experimental Station of the Agricultural College, submitted a report of his experiments made during the year. The first experiment given was with wheat, drilled, which showed a handsome profit over that made by a plat adjoining, sown broadcast. In preparing the land, furrows were run about 15 inches apart, throwing up the ground in sharp ridges. The wheat was sown in this listed land, the most of it falling in the open furrows. A bull-tongue plow was then run through the ridges, and the wheat was completely covered. The seed sown was at the rate of one-half bushel per acre. The plat adjoining was sown broadcast on the 1st of November, at the rate of two bushels per acre. The only additional labor used on the drilled wheat was one furrow run between the rows during the month of March, when the wheat was in the joint, with a subsoil-plow. The helve of the plow being a bar of iron, no dirt was thrown on the wheat; but it answered the double purpose of opening and draining the land, and the good effect was soon perceptible. It grew off much faster and was some 6 inches taller, with much heavier heads than that sown broadcast. The variety sown was the Boughton or Tappahannock. The broadcast plat made at the rate of 414 pounds of grain to the acre, (6.09 bushels,) and the straw weighed 836½ pounds. That sown in the drill made 517½ pounds of grain, (8.62 bushels,) and 812 pounds of straw. Plat No. 3, fertilized with 300 pounds of ammoniated superphosphate per acre, with the same amount of seed drilled, produced 12.07 bushels of grain, (equal to 724½ pounds,) and 979 pounds of straw. The cost of the fertilizer used was $9.75. Plat No. 4, with double the amount of seed, treated in the same way, produced exactly the same amount of grain, but more straw—1,059 pounds—showing that the tendency of thick seeding is to produce more straw and less grain. Plat No. 5, same amount of seed drilled, with 300 pounds of superphosphate, produced at the rate of 700 pounds of grain, (11.67 bushels,) and 1,043 pounds of straw. The fertilizer cost $7.50 per acre, and produced three bushels more than that without any fertilizer.

Mr. Pendleton gives the following experiment with oats: On the 18th of December, after having prepared his ground with 500 pounds of home-made manure, he sowed a yellow Georgia variety, at the rate of 1½

bushels per acre. The product was 29⅞ bushels of grain. The total cost of production was $14.25; value of oats and straw, (1,275 pounds,) $33.69; net profit, $19.44. Mr. Pendleton thinks that with a sound, healthy seed, sowed from September to January, and well fertilized, oats can be made as reliable a crop in Georgia as either corn or cotton.

The following experiment, showing the necessity for the use of proper fertilizers in the production of cotton, is given:

We took a small plat of the poorest soil, (which, however, had been fertilized last year, and had some of the elements of fertility carried over,) and opened the cotton-rows with a turning-shovel, each way. In this we deposited a mixture at the rate of 500 pounds per acre, and listed on it. We then scattered 500 pounds broadcast. On the 30th of last month we had the forms, blooms, and bolls carefully counted, and there were in an average row, nine yards long, 1,420, there being 111 bolls. In one of the middle rows of the four unfertilized by its side, there were only 261 forms, 2 blooms, and 1 boll. The contrast in the weed was more marked than this. The 1,000 pounds of fertilizer applied contained the following elements: 12 pounds ammonia, 25 pounds organic nitrogen, 160 pounds bi-phosphate of lime, 90 pounds muriate of potash, 13 pounds chloride of sodium, 10 pounds sulphate of magnesia, 140 pounds sulphate of lime, 10 pounds sulphate of potash, 120 pounds bone phosphate lime, 250 pounds of organic matter, exclusive of nitrogen already mentioned, 100 pounds of water, 30 pounds of silica, and 40 pounds of alumina, iron, and manganese. The whole cost about $30.

Mr. Pendleton closes his statement with the following experiment with green weeds as a fertilizer for cotton-lands:

Last autumn we took 200 pounds of green weeds and put them in a row seventy yards long, and covered them with a turning-shovel. Another 200 pounds we burned to ashes, thus dissipating all the organic matter, and bedded on in the same way, and nearly at the same time. Planted both rows in cotton the past spring. The cotton in the row where the weeds were put has the appearance now of being treated with 200 pounds of a good fertilizer, while the rows fertilized with the ashes do not seem to have been benefited by them scarcely at all. This teaches us the importance of vegetable matter, especially in the green state, although the dry might possibly have done as well, as the water would have been the main principle lost.

We stumbled, by accident, upon another fact of interest to cotton-planters. Intending to test the proper width of cotton, we laid off the rows of two plats, side by side, one 2½ feet wide and the other 3½, bedded up and planted. I noticed the cotton in the narrow beds came up first, grew off better, and left a much thriftier stand than that in the wide beds; and up to the present time the cotton is better and heavier fruited. The lesson taught is this: Of cold, rainy springs, as most are, you should make narrow beds, even though you want wide rows.

Mr. R. H. Hardaway read a paper on the advantage of small over large farms, and, in proof of his position, submitted a report of the products of his farm of fifteen acres, of common pine-land, from 1866 to 1873, inclusive. He practiced intensive farming, and a partial system of rotation of crops. Without giving his statement in detail, the total cash-receipts from his fifteen acres of land were as follows for the years named:

		Value of crop
1866— 6	acres of corn and 9 acres of cotton	$1,127 18
1867— 5	acres of corn and 10 acres of cotton	1,185 80
1868—15	acres of cotton	1,721 44
1869—15	acres of cotton	1,614 02
1870—15	acres of cotton	1,316 41
1871— 2	acres oats, 6 acres cotton, 4 acres corn, 1 acre potatoes, 2 acres rice	926 75
1872— 4	acres corn, 4 acres cotton, 7 acres oats	951 60
1873— 3	acres corn, 5 acres oats, 1 acre potatoes, 6 acres rested	634 00
	Total value of crops for eight years	9,477 20

Mr. Hardaway gives the cost of labor for the cultivation of these fifteen acres at $100 per annum, and adds to cash received from products of the farm, premiums amounting to $575; making his total cash-receipts $10,052.20 for the eight years, with but $800 deducted for labor.

The returns of the tax-receivers of the State, made under oath, gives the following average yield of the three crops named, for the year 1873: Corn, five and one-half bushels per acre; oats, four and one-half bushels; and one bale of cotton to three and one-half acres of land. Comparing these results with the crops made on his own farm, Mr. Hardaway says:

1866.—The two hundred and fourteen bushels of corn produced by me on six acres would require forty-one acres, and the seven bales of cotton made by me on nine acres would require twenty-four acres. Here, then, would be sixty-five acres against fifteen acres, and an additional expense of $392.45 for cultivating the extra fifty acres.

1867.—The one hundred and sixty-nine bushels of corn produced by me on five acres would require thirty-three acres, and the nine bales of cotton which I made on ten acres would require thirty-one acres. The case stands thus, for this year: Sixty-four acres against fifteen acres—forty-nine acres less, and $392.45 of extra expense saved in cultivation.

1868.—Fourteen bales of cotton produced on fifteen acres, the amount of my crop for this year, would require forty-nine acres, with the extra amount for cultivation.

1869.—Fifteen bales of cotton on fifteen acres, against the same amount on fifty-three acres: a difference of thirty-eight acres and $392.45 of extra expense in cultivation.

1870.—I this year made eighteen bales of cotton on fifteen acres. Taking the State average, it would have required sixty-three acres to have produced this crop—a saving of forty-eight acres and the difference in the expense of cultivation.

1871.—This year I made 168 bushels of oats on two acres against thirty-seven; five bales of cotton on six acres against seventeen; 168 bushels of corn on four acres against thirty-two, a saving of seventy-four acres with the additional expense of cultivation.

1872.—My crop on fifteen acres was as follows this year: Two hundred and eighty bushels of corn on four acres, against forty acres required for the same amount by the State average; four bales of cotton on four acres, against fourteen acres; three hundred and fifty-nine bushels of oats on seven acres, against eighty acres; making, in all, one hundred and thirty-four acres, against fifteen—a saving of one hundred and nineteen acres with its extra expense of cultivation.

1873.—On three acres I made three hundred and four bushels of corn, against fifty-eight acres required by the State average; on five acres, three hundred and thirty bushels of oats, against seventy-three acres; making, in all, one hundred and thirty-one acres against eight. In the eight years I have saved in cultivation an average of sixty-seven acres annually, with its additional expense of $392.45 for cultivation, aggregating a total of $2,339.60.

Mr. Hardaway stated that some of his neighbors—farmers of experience and measurable success—had become convinced of the necessity of a more thorough system of cultivation, and in order to accomplish this they had concluded to dispose of at least one-third of their farming-lands, and by rotation and a thorough system of fertilization endeavor to bring back their fields to something like their original fertility. The writer shows that this can be done, and that sixty acres can be made to produce as abundantly as one hundred acres under the present system, with a saving for labor alone of at least 33 per cent. annually.

In showing the results of a system of high cultivation on fifteen acres of land, Mr. Hardaway does not desire to convey the impression that all farms should be reduced to such small dimensions, but he does insist that small farms properly cultivated pay a much more liberal per cent. on the investment than larger ones. He says:

If I had a thousand-acre plantation I would cut it up into one and two horse farms and see to it that no one hand or head of a family should run more than two plows, or more than one plow to three good hands. Break up this false system of planting huge cotton-crops and depending on getting extra help to chop out and pick out cotton. Two-thirds of the failures to make a crop are traceable to this system. This is one of the largest leaks on the farm, and is rotting out the land. The next evil to correct is the system of laborers and renters selling off their part of the corn-crop as soon as it is gathered, for whisky, tobacco, &c. There is scarcely a large farm or plantation in Georgia on which can be found a laborer who has corn enough to furnish him beyond the 1st of January, and at the same time but few farmers in the State fail to make enough breadstuff to subsist man and beast, if proper care is taken of it. * * * * Plant enough breadstuffs yearly to supply yourselves bountifully and have some left to supply the non-producer. Raise your own bacon, beef, and mutton, and have some to sell. When you gather your crops see that they are properly housed under dry covers, and all under lock and key. Feed your own stock; don't ask

anybody to do what you can do yourself, and you will always have fat stock. Have a shelter for every animal and prepare for properly saving manure. Look after it daily, and do not leave it out exposed to the sun and the rain; keep it in piles under shelter, and always ready for composting. Be master of your own farm, and correct evils as they happen.

Dr. J. P. Stevens read a paper on the subject of cheap fertilizers and the necessity for a better system of rotation of crops. He alluded to the subject of green-soiling, and summed up the advantages of regenerating exhausted lands by this method as follows: 1. Economy in transportation and in the application of manures; 2. The rapidity of their decomposition; 3. The saving of all the constituents of the manure; 4. The elevation of the temperature of the soil in the process of decomposition; 5. The protection of the soil from the effect of solar heat, preventing the evaporation of moisture, and retaining in the soil the fertilizing gases derived from the atmosphere, which decomposes the vegetable matter in and upon the soil; 6. The pulverization of the soil, making it loose and friable, by the chemical changes at work in the process of the fermentation of vegetable matter. He designated clover first, and cow-pea vines next, as the best possible of all green-crops to be used for this purpose. Of the latter he said:

Next in importance to clover, as a regenerator of the soil, and having similar habits in feeding largely from the air, is the cow-pea. We cannot too highly estimate this boon to the cotton-planter as an article of food, as well as a fertilizer for exhausted soils. More nutritious than corn, and flourishing upon soil where the latter languishes and does not pay for its cultivation, we regard this pea to the southern planter what clover is to the northern farmer. In comparison with clover, as a renovator, it is superior, in growing off more rapidly on thin soils, and in producing a larger amount of vegetable matter in a shorter time; but it has the disadvantage of being an annual. It is, however, rich in materials that contribute to the resuscitation of exhausted soils.

In regard to prepared fertilizers, he recommended a compost of cotton-seed, acid phosphate of lime, and woods-earth as one of the best fertilizers he had ever used. It will last two or three years, and does not cost more than half as much as a good standard commercial fertilizer. With no more than thirty pounds of this compost used to the acre, he could produce at least one bag of cotton. Still he regarded the turning under of green-crops as the cheapest and most effectual method of fertilizing lands. This alone, in a few years, would thoroughly enrich any soil, however greatly exhausted; and then, by a proper rotation of crops, its fertility could be easily retained.

During a debate which followed the reading of this paper, Mr. T. C. Howard said that he regarded cotton-seed as the basis of the very best manure that could be made, and expressed the opinion that every farmer could manufacture a fertilizer from this material equal to the very best. He gave the following formula for a fertilizer, which he regarded as equal to any he had ever used:

6,000 pounds of cotton-seed, worth	$30 00
1,000 pounds acid phosphate	23 00
1,000 pounds plaster	8 00
1,000 pounds salt	5 00
200 pounds kainit	12 00
2,000 agricultural lime	10 00
11,200 pounds	88 00

He had thoroughly tested this compost, and believed it could be depended upon under any circumstances where a fertilizer was needed. Mr. Howard then briefly alluded to the importance of grass-culture and sheep-husbandry as a means for the regeneration of exhausted soils. He said:

It does seem strange that so few people know the fact that sheep and Barmuda grass are among the very best methods that can possibly be adopted to enrich land. One hundred

sheep will in every ten nights make an acre of the best low-ground land on the top of the poorest hill in Georgia. Just to think of any farmer being able, with almost no expense or trouble, to make by this means the finest of bottom-lands all over his poorest hills. It should encourage everybody to raise large flocks of sheep. And then, as to Bermuda grass, I know there is a great prejudice against it. I have heard men threaten to kill any one who would plant a sprig of it on their land. Their ignorance is deplorable, but they will doubtless learn better after a while. It is the finest grass for pasturage in the world—the richest, the most nutritious. No other growth can possibly, so rapidly, and so greatly enrich the land. The poorest soil, if kept well in Bermuda grass for three years, with the addition of sheep on the sod, will produce fifty bushels of corn per acre. And it can be easily destroyed; farmers ought to know this fact, but they do not.

Dr. E. C. Hood read a valuable paper on the subject of green-soiling. In alluding to the limited supply of the various compositions which enter largely into the manufacture of artificial or commercial fertilizers, he spoke as follows of the inexhaustible deposit of bones of marine animals underlying the city of Charleston, South Carolina:

A large deposit of the bones of marine animals, rich in phosphoric acid, some years since discovered underlying the city of Charleston, promises an inexhaustible supply of fertilizing material. But, like many other valuable materials in nature, it requires labor and expense to prepare it for the farmer's use. It is crystallized into solid rock, which has to be mined, burned, ground, and then treated to sulphuric acid, to make the phosphoric acid soluble before it is ready for plant-food. Several companies are now producing what are called the South Carolina phosphates, which have been used with much success during the past few years.

These phosphates were also highly spoken of by Prof. W. L. Brown, who read a paper on the subject of fertilizers. He alluded to the following extract from a letter from Prof. J. B. Lawes, of Rothamsted, England, originally addressed to a member of the Massachusetts State Board of Agriculture:

You have one of the best phosphates which the world produces—one which can yield a commercial phosphate cheaper than any other. * * * The net cost, at Charleston, ready to pack into bags, ought not to be more than 40s. per ton of 2,240 pounds, and all the phosphoric acid should be rendered soluble except 2 or 3 per cent.

During the last day of the convention, papers were read on the following subjects, viz: "Flour and its manufacture," by Mr. James A. Stewart; "Interest and usury laws," by Mr. R. W. Jones; and "Direct trade with Europe and other foreign countries," by Mr. David S. Johnston.

KANSAS.

The annual report of the Kansas State Board of Agriculture for the year 1873 is one of unusual interest. It contains a vast amount of statistical matter, relating to the increased agricultural productions of the State, in addition to which are given the business transactions of the society for the year; the list of premiums offered and awarded at the late State fair; reports from a large number of county and district societies; two or three excellent papers on the subject of entomology, from the pen of Prof. C. V. Riley, and a number of addresses and well-written papers on subjects of interest to the farmers and fruit-growers of the West. It also contains a brief but succinct history of the society from its organization up the present time. From this history, it would appear that the legislature has often recognized the importance of the association as a stimulus to the progress of agriculture, by repeatedly lending it aid of a material character, and by the enactment of liberal and wholesome laws for its government. The law relating to the collection of statistics and industries of the State, approved March 3, 1873, provides that statistics relating to the various industries of the State shall be collected by the respective township trustees at the time of taking the lists of property for taxation in the several townships, cities, or wards in the State. These returns are required to be made to the county

clerks, by whom they are tabulated by townships, and returned to the State Board of Agriculture. Then it is made the duty of the State board to publish, as a part of their annual transactions, a detailed statement, by counties, of the various industries of the State, and other statistics which shall be collected from the returns of the county clerks, and from such other reliable sources as the said board may deem best. Also, to collect, arrange, and publish, from time to time, in such manner and form as the said board may deem to be for the best interests of the State, such statistical and other information as those seeking homes in the West may require. The law also provides for delivering a synopsis of the same to immigrant-aid societies, railroad companies, real-estate agencies, and others interested; and for the arrangement, in suitable packages and cases, for inspection, in the agricultural rooms, samples of agricultural products, geological and other specimens, which the assessors are required to collect and forward through the county clerks. Another act, approved March 6, 1873, provides for an annual enumeration of the inhabitants of the State, said enumeration to be made at the same time the property is assessed for taxable purposes. From the census thus taken it would seem that the State had increased its population within three years—1870 to 1873—240,664; that is to say, from 364,399, in 1870, to 605,063 in 1873. There are twenty-nine unorganized counties in the State, from which no returns were made. The secretary estimates an average of 200 souls to each of these unorganized counties, which, added to the population of the organized counties, gives 610,863 as the aggregate population of the State—a gain of 246,464 in three years; an average gain of about 82.154 per annum. The per cent. of gain in three years has been 67.63.

Winter wheat is a successful crop throughout the State, but spring wheat seems to do much better in the western than in the eastern counties. In the older portions of the State, therefore, winter wheat is taking the place of spring wheat, for the reasons that the latter invites the chinch-bug more than any other crop, yields less per acre, and is not worth so much per bushel. The average yield of this crop in the State is given at 15.7 bushels per acre. The average yield of winter wheat was considerably above this. The rye crop was very successful, and averaged 21.1 bushels per acre. The entire product of the State for the year 1873 is given at 301,957 bushels. Owing to the excessive rains of this year, which prevented proper tillage, and which were followed by a severe drought during the formation of the ears, the reduction of the corn crop of the State, as compared with the crop of 1872, is given at from 20 to 50 per cent., or an average of about 35 per cent. This reduces the crop to about 29,683,843 bushels, the entire product of the State for this year. The crop of 1872 was the largest ever produced in the State, and amounted to 45,667,451 bushels.

Of the comparatively new productions of the State, the secretary gives the following brief summary:

In 1870 no castor beans are reported; in 1872, 19,352 bushels; in 1873, 59,435 bushels, or a gain of 207.12 per cent. in one year, from 1872 to 1873. In 1870, 2,800 pounds of cotton were reported; in 1872, 22,772 pounds; in 1873, 251,222 pounds, a gain of 228,450 pounds or 1,003.21 per cent. in one year, from 1872 to 1873. In 1870 the flaxseed product was 1,553 bushels; in 1872, 3,834; in 1873, 63,478, a gain, from 1872 to 1873, of 59,644 bushels, or 1,555.65 per cent. In 1870, there were reported 76,000 pounds of hemp fiber; in 1872, 1,222,098; in 1873, 1,410,304, a gain of 188,226 pounds, or 15.40 per cent., from 1872 to 1873. In 1870, the tobacco product amounted to 29,047 pounds; in 1872, to 201,040 pounds; in 1873, to 393,352, a gain of 192,312 pounds from 1872 to 1873, or 95.65 per cent.

On the condition of farm-animals the secretary says:

The winter of 1872–'73 was the most severe ever known in the State. There were many cases of criminal negligence, which caused considerable loss of cattle on the plains in the western part of the State. Herds of Texas cattle were exposed to the severity of the winter, and left to shift for themselves. Streams were frozen, and the poor creatures probably suffered more for want of water than anything else. Nearly all the losses reported are the result of neglect and exposure, starvation and thirst. The idea that farm animals can thrive upon the plains without care and protection is an error, For legitimate stock-raising, there is no better State than Kansas.

According to the census of 1870, the number of sheep in the State was 109,088. The estimate from the assessor's returns for 1873 is 51,116, a decrease of 57,922 in three years, or 53 per cent. Assessors have in many counties neglected to "list" most of the flocks. Thus, in Sumner County, only 39 head of sheep are enumerated. An intelligent farmer of that county reports over 600, in small flocks of from 30 to 50 each; that there has been a depletion of large flocks through wanton neglect and exposure, and a merciless abandonment to be the prey of wolves and vagabond dogs, there is no doubt. Neither pecuniary consideration nor the instincts of humanity have been sufficient to induce careful and humane treatment.

In 1860, the amount of butter produced in Kansas was 1,093,497 pounds; in 1870, 5,022,758 pounds; in 1873, 6,804,693 pounds. In 1860, the amount of cheese produced in the State was 29,045 pounds; in 1870, 226,607 pounds; in 1873, 295,019 pounds.

The following comparative statement of the value of nurseries, orchards, orchard products, and vineyards is given:

Nurseries.—In 1860 amd 1870, no report; in 1872, $227,980 invested.

Orchards.—In 1860, the value of orchard products was $656; in 1870, $158,046; in 1872, 713,954 bushels, estimated at 50 cents per bushel, gives $356,977 as the value of the product. Capital invested in orchards in 1873, $1,614,934.

Vineyards.—There were 583 gallons of wine manufactured in 1860; 14,889 in 1870; 34,505 in 1872. Assuming that twelve pounds of grapes will make one gallon of wine, and that one-half of the grape crop was marketed as grapes and one-half manufactured into wine, we have the product of 1872, as follows: Grapes manufactured into wine, 414,060 pounds; number of pounds sold, 414,060; making in the aggregate, 828,120 pounds.

414,060 pounds grapes, at 4 cents per pound	$16,562 40
34,505 gallons wine, at 75 cents per gallon	25,878 75
Making the total value of the crop of 1872	42,441 15

The amount of capital invested in vineyards in 1872 was $181,689. The average yield per acre, according to the returns of assessors, was 2,307.2.

The ninth annual exhibition of the industries of the State was held on the grounds of the Shawnee County Agricultural Society from the 22d to the 26th days of September, 1873. The exhibition was more successful than any of its predecessors. Competition was very spirited, as was shown in the fact that 98 per cent. of the premiums offered were awarded. The first exhibition of the society was held in Leavenworth, in 1863; the second and third at Lawrence, in 1866 and 1867; the fourth, at Leavenworth, in 1868; the fifth, at Lawrence, in 1869; the sixth, at Fort Scott; and the seventh, eighth, and ninth, at Topeka.

Mr. R. S. Elliott, industrial agent of the Kansas Pacific Railway, contributes an interesting and valuable paper on the subject of the climate and capabilities of the soil of a vast tract of land in Western Kansas, familiarly known as "the plains." In the course of this article the writer makes the following statement in regard to recent experiments in the cultivation of these lands:

Persuaded, that the soil and climate of the plains had been undervalued, the managers of the railway ordered experiments in cultivation to be made, at points beyond the settlements as existing in 1870. The experiments ran through 1871, 1872, and 1873, and have resulted in a very satisfactory measure of success.

At the first point, Bosland, two hundred and thirty-nine miles west of Kansas City and 1,586 feet above sea-level, the growth of forest trees, transplanted and from seed, and of wheat, rye, corn, sorghum, and other crops, has been such, that any one looking at the

field might well imagine himself in Illinois or Missouri, rather than on the high plains of Western Kansas. This field in the spring of 1871 was west of all settlements in Kansas, but they have since extended eighty miles beyond.

At the second point, Ellis, three hundred and two miles west of Kansas City, and 2,019 feet above sea-level, forest trees, transplanted and from seed, have in some instances made surprising growth; and wheat, rye, corn, and other crops have equaled the production of localities supposed to be much more highly favored.

At the third point, Wallace, four hundred and twenty miles west of Kansas City, and 3,200 feet above sea-level, near the west line of the State of Kansas, and in a portion of the plains extremely unpromising, success was not expected equal to that farther east, yet has been such as to show that in average seasons and without irrigation, grain and forage crops will reward the sheep and cattle farmer with cultivation and care. That a single tree should there survive without irrigation and not near a stream to get the benefit of underground moisture, was a few years ago not believed possible; yet several varieties of transplanted forest trees, among them the ash, elm, and honey-locust, have grown moderately but steadily for three years; and trials have also shown that trees may be grown from seed in that locality.

All the experiments were made in districts pastured by the buffalo in 1871. There was no irrigation; the trees had no mulching or other protection. There was none of the particular care usual in nurseries. All the conditions were such as to make the tests severe, so that any success attained should be reliable. So far as we may judge from trials running through three years, these experiments justify the conclusion that grain and forage crops, forest trees, and hedges may be grown on the plains to the west line of Kansas, and probably to a considerable distance beyond, depending only on the rain-fall.

The address of Dr. J. A. Warder, of Ohio, on the subject of forest-tree culture, delivered before the members of the Kansas legislature, is contained in full in this volume of the transactions of the State board. It contains many valuable suggestions as to planting and the proper treatment of forest-trees, and concludes with the following directions as to varieties and location:

Always remember the importance of endeavoring to select those especially adapted to the soil; next, those of quick growth and of early maturity, those with valuable qualities, and always plant the hardy kinds first, as nurses for the others, thus:

In open plains.—Ailantus, cottonwood, elms, ashes, willows, silver-maples, box-elder, abeles, and other poplars; all as nurses to others adapted to the soils.

On deep rich bottoms.—Elms, ashes, walnut, burr-oak, cypress, coffee-nut, pecan-nut, maclura, tulip-tree, cottonwood.

On second bottoms of loess, (found as bluffs on some of the larger streams.)—Tulip-tree, wild cherry, sugar maple, hickories, catalpa, white oak, sassafras.

On deep soils, upland.—Maples, ashes, cherry, oaks, honey-locust, coffee-nut, pecan, maclura, hickories, catalpa, larch, pines, spruces.

On heavy soils.—Burr-oak, white oak, yellow oak, post-oak, beech, hickories, maclura, cedar, pines, locusts, birches.

On sandy lands.—Larch, spruces, pines, cedar, red oaks, chestnut, ailantus, sassafras.

On rocky bluffs.—Chestnut, cedar, pines, spruces, larch, locust, chestnut-oak, sugar maple, ailantus.

On swampy land.—Cypress, birches, willows, pin-oak, (*Q. palustris*) swamp white-oak, green and black ash, alder, arbor-vitae.

MASSACHUSETTS.

The twenty-first annual report of the Massachusetts State board of agriculture for the years 1873–'74 contains over six hundred pages of interesting matter on agriculture and kindred subjects. The essays and discussions contained in this work bear evidence of deep research and long practical experience in the matters treated of and discussed at such length, and the volume, as a whole, must take high rank among the valuable current contributions to the agricultural literature of the year.

The secretary, Mr. C. L. Flint, congratulates the farming community of the State on the fact that, notwithstanding the forebodings through the early spring, caused by a drought of more than usual severity at that season, the year just passed has been one of general prosperity. The first crop of hay was light in the eastern and middle portions of the

State, though more frequent showers on the hilly ranges west of the Connecticut River and Berkshire County seems to have carried the crop through to a more satisfactory yield there, while the favorable conditions of the later season, and the very late occurrence of frost in the fall, produced an abundant second crop of grass and a luxuriant growth of fall seed.

Reports from local societies of the State show most of these associations to be in a prosperous condition. Where the conditions as to weather were favorable the receipts at their fairs were large and remunerative, while the display of improved stock, farm and orchard products, and articles of improved industry, gave abundant evidence of progress and prosperity. The secretary thinks these local societies have been productive of great good. They have created an interest and enthusiasm in many sections where little or none existed before, and led many to a higher level of thought and effort. But there is still room for improvement. Too much time and attention seems to have been given to the race-track at many of the fairs of these societies. This has led to abuses, which no doubt will be speedily remedied. They should realize more fully the magnitude, the dignity and the character of the mission they have to perform in the development of the material interests of the State. They have it in their power to lift the labor of the people to a much higher plane of thought, and to lead the way to still greater triumphs of skill and intelligence.

The country meeting of the board for this year was held at Fitchburg on the 2d, 3d, and 4th of December, 1873. The meetings of the board were held in the city hall, and were largely attended by the leading agriculturists of the State. There were also present many prominent gentlemen representing the agricultural and productive industries of other States. The opening address was made by Mr. Eugene T. Miles, who was followed by Mayor Norcross in a brief address of welcome. President Clark, of the agricultural college, was then invited to the chair, and presided during the after sittings of the board. The first paper read was one entitled "A hundred years' progress of American agriculture," by Mr. Charles L. Flint. This essay appeared in full in the annual report of this Department for 1873.

The afternoon session of the board was occupied in listening to the address of Mr. Harris Lewis, of New York, on the subject of "Milk," and the discussion which followed. Mr. Lewis stated that notwitstanding milk was composed of from 87 to 88 parts of water, and only from 12 to 13 per cent. of butter, cheese, milk, sugar, and earthy matter, yet as an article of food it was capable of sustaining man from the hour of his birth until the hour of his death. It will supply every need of the system, and build up every bone and tissue of the whole structure. And yet it is the cheapest food known to us. Taken at the price it brings in market, there is no animal food which compares to it in cheapness. There is no cost in its preparation for food—no waste, as in the case of other animal substances; no refuse of bone, although an abundance of bone-forming material.

In alluding to the consumption of milk as an article of food, the speaker stated that the people of Massachusetts use less milk, and those of Virginia use more, than the people of any other State in the Union; and as to quality, that the city of Boston is supplied with a better article of milk than any other city in the United States. The value of the milk-crop of the United States has heretofore been estimated at $400,000,000 annually, but Mr. Lewis thinks it will reach $500,000,000 annually.

The speaker gave the following simple plan for testing the value of milk by its specific gravity:

The better the milk the lighter it will be, because the better portion of the whole is the lightest of all. Therefore, to test the question in regard to the specific gravity of water, and water and cream, mix some cream in a tumbler of water. (get the purest water you can; dissolve some clean ice, as that will be as good as any you can get unless you get distilled water,) mix them together, and see where you will find your cream and where you will find your water. I have found a variation in the specific gravity of milk of different cows in my own herd equal to 10 per cent., and that shows the importance of such tests, in order to select good butter-cows and good cheese-cows.

In regard to the different taints in milk, and the discovery of a partial remedy therefor, Mr. Lewis said:

Milk comes to us at regular periods, and in measured quantities. It is not like any other article of food. This matter we can control in all other respects, but milk comes to us in increased quantities at even periods of time, if we milk our cows as we should and treat them as they should be treated; and it comes loaded with germs that are capable of destroying it; it is full of germs that are prepared for its own destruction. Now, these putrefactive germs that we find in milk act just according to the conditions in which the milk is placed; we may retard or accelerate their action. Milk also comes to us with what we call a "cowy odor," or 'animal odor," as it is sometimes called. This odor, of course, seems to be stronger and more offensive in hot weather than in cool, and it is more perceptible in a sick cow's than in the milk of a well one. Take a cow that is feverish, and it is terrible, awful. It smells bad, tastes bad, and it is the very element in milk that makes it unpalatable to most people. There are but few people who can relish new milk as it is drawn from the cow. This animal odor is one of the worst things we have to contend with in our butter and cheese factories. What it is I have not yet fully decided on for myself.

The first thing we ought to do with milk, if we want to keep it a long time, is to rid it of this animal odor. If we want to make it palatable and good, we must get this out. A gentleman in New York has brought out a simple contrivance for doing this. I am sorry he has got it patented. It is simply a tin pail, the bottom of which is perforated with one or two rows of holes. We turn our milk through a strainer, fastened over the top, and it comes out through the holes. It starts in streams, but before it gets down more than a foot or 15 inches it is separated into drops, and all aired. We all know what a deodorizer pure air is. We depend upon its action upon the blood for every breath we draw. Now, that simple arrangement, inexpensive, easily kept clean, is the best I have ever seen. It is simply a large tin pail, without a bail, the tin turned over a heavy wire at the top, and that is held in an iron arm that goes into a standard fastened to the can, suspending it over the center of the milk-can, and the bottom drilled or punched full of holes three-sixteenths of an inch in diameter; the milk, as I have said, starts out in streams and separates into drops before it reaches a distance of more than 15 inches below the bottom of the strainer. It is the easiest to keep clean, is the cheapest, the most readily used, and effects the object the most perfectly of anything I ever saw, and, I repeat, I am sorry it is patented. We use forty-gallon cans for carrying milk, but this can be used anywhere, on any can, by using a funnel below, if you have too small a mouth to the can. You can place it just as high as you please; when the wind blows you do not want it but a little way above the ground. When the atmosphere is still, or very hot, the higher you get it the better. I made a good many tests with it a year ago last July, in the hottest weather we had, and I found no difficulty whatever in keeping the milk sweet thirty-six hours.

After stating that milk should never be aerated with impure air, the speaker stated some experiments in keeping milk under different circumstances, and remarked that an article of food so perishable as milk should be handled with the greatest of care. If freed of all its impurities, taints, and odors, its value as an article of food may be enhanced 100 per cent., and its consumption increased to an equal extent. Milk and its products of butter and cheese are valued by the last impression left on the organs of taste. If that impression is agreeable as it fades away, a desire for more of it is felt. If, on the other hand, the impression is a disagreeable one, an aversion is created, and a further indulgence is avoided. By this indifference in the handling and preparation of milk, this lack of cleanliness, the demand for milk and its products will always remain limited. He does not think the market could ever be overstocked with a good article of butter and cheese. To pre-

vent the adulteration of milk, he speaks as follows of the importance of tests with the lactometer:

It has seemed to me that the lactometer was a very sure test of milk, from the fact that if we take milk that we know to be pure, and it is so represented by that instrument, and then put in 50 per cent. of water, the lactometer will indicate 50 per cent. of water; if we put in 25 per cent. of water, it will indicate 25 per cent.; and if we put in ten per cent. of water, it will indicate 10 per cent. If it does not tell the truth absolutely, I believe it has done a vast amount of good, because individuals bringing milk to the factory have noticed that we tested their milk; and if some of us know that it does not tell the absolute truth, the generality of people suppose that it does, and they know that we are looking after them, any way. It has seemed to me that it must indicate the truth, because, if you take pure milk, as I have said, and dilute it, it indicates the per cent. of water put in.

During the discussion which followed, Mr. Rowell stated that usually the lactometer was very correct. At one time, when milking forty cows, he took a sample of milk from each cow, cooled them off as nearly alike as water from the same trough would cool them, and from these forty samples he did not find half a degree difference. In the many trials to which he has subjected the lactometer, he has never known it to be over a half degree out of the way. Where he had been in doubt he had sent samples of milk to the chemist, and his analyses had shown that in no case had the lactometer been more than half a degree out of the way.

On the subject of airing milk, and the great importance of freeing it from all impure taints and offensive odors before using it in the manufacture of cheese, Mr. Root said:

At the factory which I represent, in the spring of the year we instituted a most rigid procedure. We suggested this course to a part of the patrons of the factory, that they should bring in their milk at a certain time, and have it made up independently of the milk of other parties. We suggested that that milk, after it had stood for an hour, and had cooled somewhat, and the cream globules began to separate a little, should be all aerated, and we suggested this process: You have got six cans of milk; take a seventh can and set it in a place where the air will blow briskly; raise up one of the other cans, and pour that milk slowly from this can into that. By doing this all that milk is aired; the air is carried into the milk and it is aerated to a certain extent. Then we requested them to take their morning's milk (they carry it only once a day) and take the same course with that. This experiment was followed for a certain length of time. That milk, carried in at night from four dairies, making about 1,600 in a day, was taken to the manufactory, placed in the long vat, and skimmed in the morning, and the cheeses were made up separately and kept in the ordinary way. The result was this: that an equal quantity of cheese was produced from that milk that had been skimmed, only you could not get very much cream from milk in the first part of June by that arrangement. It was sent, it is true, to another market from the market to which the other cheese was sent, but it brought a little more a pound than the other. I took different individuals into the factory, where there were three or four sixty-pound cheeses, bored into a cheese, and let them try it; they pronounced it very fine cheese. Then I took them to the next one, and they said "I don't see any difference;" or perhaps, "I should say this was the best." In one case, one man said those four cheeses were better than those made of milk from which the cream had not been skimmed. It was so, and no mistake: they were better cheeses. More cheese, I claim, was produced from the milk that was cared for in that way than would have been produced from it if cared for in any other way; and I say that milk so prepared is more valuable, keeps longer, produces a better article, and what is better yet, the cheese will, I think, keep longer and retain its best qualities. * * * The main reason for the difference in cheeses is owing to the difference in the milk. We can not control all the elements which produce the milk; it is almost impossible. If a thunder-storm comes up just at evening, after we milk, the elements are against us then. In such a case as that the dairyman should know the fact, and the man at the factory should know that fact. The dairyman should hasten in with his milk in the morning as early as possible, and the foreman at the factory must handle that milk in a peculiar way to make the best cheese.

During the evening session of the board, Hon. Marshal P. Wilder read an entertaining paper on the "Importance, progress, and influence of rural pursuits." Professor Charles A. Goessmann, of the agricultural college, opened the second day's session with a valuable paper on the subject of "Some home resources of fertilizers, with particular reference to nitrogen plant-food."

After alluding to the experiments of Gilbert, Way, Knop, and others,

in determining the amount of nitrogen plant-food furnished by rain and other atmospheric sources, Professor Goessmann says that no one familiar with the amount of nitrogen carried off in ordinary farm-crops would hesitate for a moment to pronounce these sources of supply insufficient for the growing and maturing of crops. This being the case, a proper rotation and direct manuring alone are the only means whereby lands may be enriched with nitrogen plant-food, and at the same time be improved in their physical condition. Exact comparative analytical tests have determined that an entire average crop of wheat, rye, barley, oats, flax, and buckwheat contains but from 38 to 45 pounds of nitrogen per acre, while hops, meadow-grasses, Indian corn, rape, and potatoes contain from 50 to 75 pounds; and, finally, tobacco, peas, lupine, lucern, and beets contain not less than from 75 to 90 pounds. Yet practical experience counts, when classifying these crops with reference to their actual effect on the nitrogen plant-food of soils, grain-crops, rape, tobacco, potatoes, and other hoed crops, among the very exhausting crops; peas, vetch, and buckwheat among the most saving ones; and clover, lucern, esparcet, lupine, &c., among those which enrich, in a decided degree, the soil with nitrogen plant-food. To introduce the last-named class of crops, wherever practicable, into a system of rotation, will always operate in the interest of an economical use of nitrogenous fertilizers.

He then states that the second step toward an accumulation of ready nitrogen plant-food consists in the saving of all vegetable and animal refuse material incidental to the industry pursued, for all contain more or less nitrogen compounds and differ in fact more in regard to the quantity than the quality which they contain. The most prominent substances in this connection are animal secretions. The quality of these refuse matters depends, first, on the kind, the age, and the employment of the animal from which they are obtained; and, secondly, on the kind and the amount of food consumed. Every class of domesticated animals requires for their support a certain varying amount of nitrogenous compounds; their secretions differ, consequently, regarding their amount of nitrogen. Full-grown animals return in their secretion the entire amount of nitrogen consumed in their food; young animals retain some of it for their growth; cows pass part of it in their milk, and sheep in the wool. The secretions of high-fed oxen contain often two and one-half times as much nitrogen and three and one-half times as much phosphoric acid as those obtained from cows or young cattle.

But Professor Goessmann does not think stable-manure alone will keep up the fertility of the soil where mixed husbandry is practiced. Sooner or later it becomes an incomplete manure for the crops under cultivation, in consequence of the more or less general practice of selling various kinds of farm-produce, without restoring in some suitable form to the soil at least their ash constituents. There are two ways, however, by which this manure may be made a complete fertilizer for any farming system, and they are, to restore either the soil constituents, sold in the farm-produce, by buying rich food in addition to the fodder-crops raised, or by securing an efficient amount of a suitable commercial concentrated fertilizer. Which of these two courses will be the most economical, cannot be well decided on mere general principles beyond the statement that the first course, the buying of strong food, seems to be the safest and most efficient in general farm management; while the second course, the buying of concentrated commercial fertilizers, deserves frequent recommendation for the cultivation of certain industrial crops.

The paper read by Professor Goessmann was followed by a discussion

on the subject of fertilizers, which was participated in by Messrs. Loring, Wilder, Trask, Goessmann, Hubbard, Graves, Sessions, Lewis, Taft, Root, Bowker, Everett, Lawrence, Moore, and others. Dr. Loring spoke at some length on the subject of muck as a fertilizer. After many years' experience, he had come to the conclusion that, considered by itself, it does not contain a very great amount of fertilizing material. He thinks it belongs to those materials which nature has provided for the benefit of the compost-heap; that it can be worked into a mass of barn-yard manure in such a way as to increase the fertilizing power of that mass of pure animal excrement, just as straw can, and just as many other materials can. For that purpose, properly prepared and used as an absorbent, he regards it as valuable. He said:

Muck is applicable, therefore, in the compost-heap, to soils that are sandy and light, have an abundance of silica, have soluble salts already provided, which the latent acids in muck may possibly dissolve. Is that unfair? The chemist says, "No, it is not unfair;" he says that it is the right way to get at it. Now, I say, take sandy soil, and if you have got a sufficient supply of barn-yard manure which you wish to extend by the use of any composting material, you can use muck, and the acids remaining in the muck, after it has been exposed to the air and sun and frosts, so that it is thoroughly "sweetened," as the farmer says, will have a beneficial chemical effect upon your soil, by aiding to dissolve the soluble salts which go to nourish the plant. Just as far as that I will go on the muck question, and I think it is as far as the most cultivated chemist is usually willing to go. I do not believe in hauling out a great mass of this material, and spreading it upon our soil, with the expectation that it will alone act as a fertilizer. * * * So I would use muck on sandy land, and if I had clay-lands to manipulate, and rye-straw was expensive, I would use sand. I represent a clay-farm; almost all the land I cultivate is of that character. When I took it into my hands in 1857, it had been mucked to death; it had been filled with muck; muck was convenient; muck was popular; it had its advocates, and was accepted, as a good many other things are accepted, because no one exposes their true value. This land, I say, had been mucked to death, and having accidently discovered a large deposit of sand in the rear of my stable, I resorted to that sand for bedding for my cattle and the enlargement of my manure-heaps. The land changed in three years materially. The quality of my crops changed; half-grown, stunted mangold-wurzels were replaced by large, healthy-looking roots. Tufted grasses—that is, fields where there would be a square foot of grass and six inches intervening of barrenness—were all wiped out, and an equal diffusion of healthy, thrifty grass was secured in its stead. It was owing to the introduction of sand with the manure into those lands which had been rendered sour and pasty by the muck. That was the result of that experiment. So, I say, if you have clay-lands, extend your manure-heaps, and compost them by the use of sand.

President William S. Clark, of the State Agricultural College, read a paper on "The circulation of sap in plants." At the conclusion of the reading of this interesting paper, Professor Agassiz, who was present, took occasion to highly compliment the author for the thoroughness of his investigations, and spoke of his discoveries as of great importance. He stated, for the benefit of those who have thought that the Agricultural College was accomplishing but little, that the discoveries made by President Clark would amply pay for every dollar which the State has thus far bestowed upon that institution. It was the intention to make some extracts from this paper, but it has been found that, in order to give anything like a clear idea of the many important discoveries made by President Clark, it would require more space than the limits of these digests will permit.

The "Management of grass-land" was the next subject discussed. The subject was opened by Mr. Harris Lewis, of New York, who stated that his farm was located on the north bank of the Mohawk River, and that, ordinarily, about twenty-five acres of these lowlands are flooded by this river. These overflows occur in the spring and fall, and he has found that the sediment left by the muddy water, while it is no thicker than a piece of paper, contains sufficient fertilizing matter to give him

a year's growth of grass. This hint has caused him to make some experiments in irrigating, which he gives as follows:

I have dissolved clay and swamp-mud in water to test its fertilizing power on grass, and I find that by stirring up a pailful of spring-water and a little clay or swamp-mud together, and turning it over a given area of grass, it produces as much growth, provided the roots are healthy and vigorous, as an equal amount of manure, the liquids and solids mixed together, and spread over the same surface. On the upper end of my farm there comes in a little rill from the woodland, and this, when the snow goes off in the spring, brings down a little water, and the water is a little muddy. Well, whenever that spreads out over the pasture, on its downward course toward the Mohawk, there is no trouble in having all the grass that will grow. Hence I have taken the hint, and believe that the best top-dressing for meadows or pastures, if the roots of the grass are healthy and vigorous, is muddy water.

On the general treatment of grass-lands, Mr. Lewis said:

I do not advise top-dressing with any material whatever unless the roots are in a healthy condition. If they are unhealthy, the better way is to plow them up; but most of our grass-lands that have been in use a great while are lacking in phosphates, and you will find that a light sprinkling of bone-meal over such land will produce a wonderful effect. I have also found that much of your grass-lands lack potash, and that the application of about four bushels of wood-ashes per acre will effect a marvelous improvement. I have found, too, that in some parts of my own land, where I have top-dressed with manure for several years, a small coating of lime, say 20 bushels to the acre, will produce very beneficial results.

But I would suggest to every farmer here that he divide off a certain piece of his mowing or pasture land into alternate strips, leaving one between each two that he lets alone, and try the different fertilizers. You can try one kind on one strip, another on another, and carefully note the result, count the cost, estimate the additional growth, and each man will soon decide for himself what is the best course for him to pursue. I find that a little sprinkling of pure clay, without the water, on a light, loamy, or sandy soil, is sufficient for a long time; that a little swamp-mud, after it has been exposed to the atmosphere a year, spread over a light soil, is equal to the best top-dressing for grass-lands in the world; and I find, too, that sand, pure sand, spread over a stiff clay soil, or on swamp-muck, is an excellent fertilizer for years. But I would say to you that if your grass is unhealthy, if the roots are not vigorous, I know of no way so good as to summer-fallow, if you can do it. If your grass-land is so you can plow it, commence and make a thorough summer-fallow of it. I prefer this to sowing it with grain, cropping it, and then re-seeding it. If you are afraid of any loss of plant-food, sow with plaster before you commence, and you can add another coat during the summer Plow about three times, just as thoroughly as you would for a wheat-field, and then, about the last half of August, seed it down. This summer-fallowing rids your ground of every kind of foul stuff that may have grown in it. It gives you a beautiful clean field, where the grass-seed will catch and grow. It has the benefit of the whole of the sunshine, and it has the whole of the soil to draw upon. It has this plant-food that it obtains from the old turf, the very fertilizer that it wants; and I will assure you that you will do better by adopting this method than you will to plow it up and crop it and then try to seed it again.

In seeding lands for pastures, Mr. Lewis advises the sowing of seed of almost every kind of grass that grows, so as to get a succession of grasses during the whole season. For mowing-lands he would seed with those varieties that ripen about the same time. There being no one kind of grass that will occupy the whole of the soil, the importance of sowing seed of many varieties will readily be seen.

Mr. Fay was of the opinion that what would answer for Mr. Lewis's land would not answer as fertilizers for the lands in his section of the State. After alluding to the difference in the character of the soil of Herkimer County and most of the lands in Massachusetts, he said:

We commenced using plaster on our pasture-lands some five years ago, and we have used it until it does no good at all. You may put from 200 to 500 pounds on an acre, and you cannot see any good result from it. Ashes do not do much the first year. You will get discouraged if you try them, and perhaps the second year the benefit will not be of much sequence. If the season is very moist, sometimes you will see a little benefit the first year, but you will see the effect for ten years. I have used 25 bushels of unleached ashes to the acre. I would not give for leached ashes 10 cents a bushel, where I would give for unleached ashes 40 cents a bushel; there is all that difference between them. If you put 35 bushels on an acre, it will last you ten years, and produce an abundance of most excellent feed. There is nothing so valuable for pasture-lands, but the great difficulty is to obtain ashes.

Dr. Sturtevant spoke as follows against the practice of pasturing mowing-lands late in autumn:

My experience leads me to question the advantage of feeding mowing-lands close in autumn. On our Massachusetts soils, underlaid with gravel, the soaking of the spring rains does not preserve the roots long from the effects of the dry weather following. The grass-roots lying near the surface of the upper soil are the first to feel the drought, and allowing the grass to be closely bitten off at the approach of winter, is to expose the roots upon the coming of spring to drying winds and thirsty sunshine. To shut out these influences, and to maintain in the soil a reservoir for the growing grass from one rain to another, is, when the soil is well pulverized and rich, to have plenty of grass. This may be done by simply keeping our cattle off the mowing-fields after haying, and allowing the grass to attain a height of several inches before winter. The frost kills the grass, the snow mats it close to the roots, and the spring sun finds every root under the protection of a mulching that retains the moisture in the soil for a considerable period of time after rains.

Messrs. Root and Ellsworth spoke of their success in killing witch-grass. Mr. Root said that by plowing early in June it can be most easily subdued and thoroughly killed. Mr. Ellsworth had been successful in killing it by summer-fallowing, and gave the following as the most effectual mode of destroying this pest of the grass-lands of the State:

I have tried several different ways to kill it, and have found that the best way is to turn the ground over in the spring and sow it to fodder-corn, scratching in a little manure. If you can possibly cover the corn with dirt, it is best to do so. Sow it in the season of the year when it will grow the best, May or June. Get the fodder-corn started, and it will keep down the witch-grass. As has been remarked by one gentleman, it is pretty hard, if plowed in June, to cross-plow it that year. Mr. Lewis can do it on his land, but it cannot be done on land that is filled with witch-grass. After you get your corn off, it can be cross-plowed the same fall, and the season following there is no trouble in killing it by plowing just as often as it comes above ground, or harrowing once a fortnight or ten days, or doing anything that will disturb it. In this way you can kill it perfectly, so that you will be able to seed the land down the fall following, after you have got your crop of fodder-corn. By turning over the sod and covering it, you will kill it effectually. It wants sun and air; it cannot live without them any more than we can live under water. The most trouble that I have found with it, where I have followed it up so closely that the witch-grass was killed out entirely, was that the ground was all dust; and if there was the least slope to the land, with such showers as we have had for two years, the wash was tremendous, because it would be smooth, like a floor, and if there was nothing more than the soil to hold it, it would wash badly. I have concluded that hereafter, when I take up a piece, to kill the witch-grass in that way; after it becomes fine, I will sow it to oats. These will sprout very quick at that season of the year, July or August, and they will hold the soil from being washed away by the heavy showers.

Professor Louis Agassiz read a valuable paper on "The structure and growth of domesticated animals," being a lecture in continuation of the subject discussed by him at the preceding meeting of the board. This was the last meeting of the State board attended by Professor Agassiz, and this lecture is among the last delivered by him, as his death occurred soon after. At the annual meeting of the State board in Boston, in February, 1874, Colonel Wilder, from the committee appointed to consider and report what action the board should take with regard to the decease of Professor Agassiz, submitted the following preamble and resolutions:

Whereas Professor Louis Agassiz has been removed by death since our last meeting; and whereas his connection with this board has for many years been a great source of enjoyment to all its members and profit to the people of the State: Therefore,

Resolved, That in the death of Professor Agassiz the members of this board recognize the loss of one of the great masters of science, whose membership was an honor to this board, whose marvelous learning was freely used to foster and dignify the science of agriculture, and whose eloquence and enthusiasm gave a charm to all his instructions.

Resolved, That we recognize with grateful remembrance all he has done for the honor of our commonwealth, our common country, and for the cause of science in the world by his own investigations, and the instruction of those who remain to carry on the work begun by him.

Remarks were made by Colonel Wilder, President Chadbourne, Dr. Loring, and Mr. Phinney, when the resolutions were unanimously adopted by a rising vote.

The limited space allowed for these reviews forbids quotations from the interesting lecture of Professor Agassiz, or further notice of the many valuable papers read during the concluding sessions of the board.

The monthly publication of this department for April, 1873, contained a communication from Mr. Charles Mueller, United States consul at Amsterdam, to Mr. J. E. Whiting, of Concord, Mass., on the subject of the origin of what is generally known as the "Halstein" breed of cattle. In this communication Mr. Mueller refers to, and quotes from, a letter addressed to him by Professor Hengeveld, teacher at the Netherland Royal Veterinary Institute, Utrecht. After posting this letter to Mr. Mueller, Professor Hengeveld deemed a more copious statement necessary to establish the position assumed by him, *i. e.*, that the "Holstein" are not a distinct race, but are the descendants of the "Dutch" breed of cattle, and therefore prepared and forwarded to Mr. Mueller the following statement. As the question discussed is one of great interest to cattle-breeders, it would seem advisable to give Professor Hengeveld's letter a wider circulation than it has received through its publication in this volume of the transactions of the Massachusetts State Board of Agriculture. The letter is as follows:

UTRECHT, *November* 8, 1872.

SIR: After reading over the letter I had the honor of addressing you on the 20th ultimo, and in which I communicated to you my opinion concerning the "Holstein Herdbook," it appears to me that I have not been explicit enough in furnishing you with evidence sufficiently obvious to subvert the assumption or error of the "Association of Breeders of Thoroughbred Holstein Cattle," which association has given to the cattle imported into Massachusetts *from North Holland* the name of Holstein cattle. For this reason, I now take the liberty of giving you a somewhat more detailed statement, based upon historical grounds, in order that the injured name of our excellent cattle may be retrieved in the United States, and the real name, that of Dutch cattle, which belongs to our breed, be given it. For this purpose, I beg to adduce the following:

The testimony advanced by the "Herdbook" to show the priority of the appellation "Holstein" rests on a quotation from the splendid work of the naturalist Low, of the following import, in speaking of the origin of the "short-horns" in England: "Cattle were frequently brought from the opposite continent and mingled with the native varieties. They were chiefly imported from Holland, the cows of which country were most celebrated of all others in the north of Europe for the abundance of their milk and the uses of the dairy. * * The Dutch breed was especially established in the district of Holderness, on the north side of the estuary of the Humber, whence it extended northward through the plains of Yorkshire; and the cattle of Holderness still retain the distinct traces of their Dutch origin, and were long regarded as the finest dairy-cows of England. Farther to the north, in the fertile district of the Tees, importations likewise took place of the cattle of the opposite countries; sometimes from Holland, and sometimes, by way of Hamburg, from Holstein. Sir Wm. St. Quintin, of Scampston, is said to have procured bulls and cows from Holland, for the purpose of breeding, previous to the middle of the last century; and at a later period Mr. Michael Dobinson, in the county of Durham, visited Holland for the purpose of selecting bulls of the Dutch breed. Other persons had resorted for their breeding-cattle *to Holstein, whence the finest of the Dutch breed have themselves been derived.*" And a few lines further on—"the breed formed by the mixture became familiarly known [in England] as the Dutch or Holstein breed."

From this the "Herdbook" infers that Dutch cattle and the cattle of Holstein are of the same quality or intrinsic value, and that the former are derived from the latter.

Let us examine this more closely.

The English "short-horns" owe their origin to cattle imported from Holland, but besides these Dutch cattle there have also been cattle imported into England from Holstein and Jutland. This appears from what is quoted in the "Herdbook" from Low. The following is translated from Royer's* French version of Low's work: "In comparing these varieties of cattle to the breeds of the continent, there is an analogy found on the one side between the great breed of the marshes and the black cattle natives of the plains and marshes of Holland; and, on the other, between the more various kinds on the north of the Humber and these of Holstein and Jutland, whence the best cattle of Northern Europe have sprung. It is not unreasonable to suppose that these latter breeds may have been introduced, during the first period of Saxon colonization, by the Jutes and Angles, who settled down

*D. Low's Natural Agricultural History of the Domestic European Animals, &c. Translated by Royer. The Races of Great Britain.

in that part of England. * * * But, at a more approximate period to us, it appears that cattle were frequently imported from the neighboring continent, and that they were mixed with native breeds."

It was especially the Dutch cows that were considered the best milch kinds of Northern Europe.

There is here a very clear and evident difference made between the excellent Dutch cattle and the Holstein and Jutland breeds, whose origin Low traces to a Saxon colonization. How Low, a few lines further on, can make the Dutch cattle derive their origin from the Holstein cattle, from which lines the "Herdbook" draws its inference—the same occurs in the French version, "whence the best Dutch races themselves originate"—is incomprehensible, and it is evident Low errs, or is not sufficiently acquainted with the history of both countries: for already, seven centuries before the colonization in England of the Jutes and Angles, the Friesians [Hollanders] were known for the greater number of their cattle, as will further appear.

The foregoing quotation from Low is the only one of any value contained in the "Herdbook" in support of its theory, and this only demands attention because the statement of a great naturalist, although evidently a mistake.

The other quotations of the "Herdbook," taken from English and American writers, American-German papers, &c., as met with on pages 12, 13, 14, 38, 39, 40, and 41, prove only that the Dutch cattle are of the greatest excellence; and that the "Herdbook," in repeating on page 40 what it quotes on page 13 from the German-American farmers' paper, "the original stock was by no means bred in Holland, but in Holstein," is not so much mistaken in the matter after all, as, for reasons which it is no object of mine to surmise, bent upon establishing its theory, that paper has perhaps also been led astray in the footsteps of Low.

Another remarkable expression is used—I had almost said another gross falsehood is broached—by the "Herdbook" in tracing the origin of Dutch cattle to the Holstein breed, namely, on page 41: "Every spring, thousands of Holstein heifers are driven to the fields of Northern Germany and Holland, where people find it is more profitable to buy heifers than to raise them; and the name of the breed got confused, so that the name 'Holland cow' was here translated into 'Dutch cow,' &c.: What, in the name of common sense, next?

The "Herdbook" takes the unwarranted liberty, whenever is should speak of Dutch cattle, of adding immdiately after, the word "Holstein." It gives to Holstein cattle—*purchased in North Holland*, and of which the first importation took place in Massachusetts in 1852, afterward in 1857, &c., but the greatest in 1861—all the honor the Dutch cattle so abundantly deserve, and appears to have made the geographical blunder of supposing North Holland, Friesland, Groningen, and Oldenburg as belonging to Holstein.

The thesis so arbitrarily adopted and set forth by the "Herdbook," that the large black and white cattle imported into North America from the Netherland provinces of North Holland and Friesland have "undoubtedly descended from the original stock of Holstein," as it proclaims on page 9, requires a most decided denial and refutation for the honor and reputation of Dutch cattle; and, without being led astray by the most strangely-jumbled-up references mentioned, I wish to point out—

1st. That the history of the Dutch or Holland cattle dates further back than that of Holstein;

2d. That the Holstein cattle descend from the Dutch; and,

3d. That the name of "Holstein cattle" is only a local appellation for a peculiar indigenous breed, constituting only one of several appertaining to the same group, namely, to the group of the lowland races, of which *the Dutch breed is the fundamental type*. To this I now proceed.

According to the "Allgemeine Deutsche Real Encyclopedia,"* the origin of Holstein-Schleswyck lies buried in obscurity, and Holstein was probably visited by the Cimbri; while, a century after, the Roman Emperor Cæsar Tiberius arrived with his army and fleet before the mouth of the Elbe, without, however, setting foot on the Holstein shore. According to Tacitus, it may be stated that the Holstein Baltic coast was inhabited, as far as Mecklenburg and Sleswyck, by seven petty German tribes, of whom the Angles and Warnes have preserved their names down to the present time, while the others have been melted down into that of the Saxons. In the fifth century, the Saxons and Angles united with the Jutes and Friesians, and migrated to England. (This is Low's colonization.) Subsequently the Holstein Saxons, who dwelt to the north of the Elbe, were called by the name of Normans, while the name of Holstein is not mentioned in history before eight hundred years after Christ. In 1128–'64, the Holstein province Uagrien was conquered and converted to Christianity, and partly peopled with strange colonists from Friesland, Holland, and Westphalia.

These are hsitorical facts, agreeing with Low, and with what the editor of the "Massachusetts Ploughman," of 28th September last, quotes from a letter written by you, to the following effect: The first Dutch colony in Germany, then called by the general name Thuringia, dates back as far as the year 528. From 801 to 864, St. Anskar, primate of Bremen, Hamburg, Holstein, &c., himself of Flemish birth, attracted many of his countrymen to those northern regions. Charlemagne also colonized Flemish peasants on the shores of

* Leipsic: F. A. Brockhaus, 1866, 8th part, p. 57, &c.

the Elbe. That stretch of teeming lowlands east of Bremen to the Baltic wore a vastly different face in those early days. Marshy and uncultivated, the coast edge. of those parts stood exposed to the tender mercies of the sea to such a degree that even a slight breeze would suffice to cause immersion; while the inhabitants, through intestine wars, demoralized and habituated to strife and broil, evinced but little aptitude for the peaceful pursuits of husbandry. It was then that the attention of German princes was drawn to Holland, where similarly-situated regions had been brought to a high state of productiveness. The great tide of migration, however, did not set in till the twelfth and thirteenth centuries, from which period the origin of the fine grass-lands along the Elbe and the Weser must be reckoned, &c.

I beg to refer the reader to the further contents of this important article, as inserted in the "Ploughman," just mentioned, and take the liberty of adding that Mr. Mueller has therein strictly adhered to the historical truth.

From these historical statements, it already appears that, with regard to its fitness as a grazing and cattle-breeding country, Holstein is of later date than Holland; which fact will appear the more prominent after some account has been given of the oldest inhabitants of Holland, and their pursuits.

For this purpose I at once direct the attention of the reader to the coming of the Friesians and Batavians. The former were the oldest inhabitants of Holland, and were known as herdsmen, hunters, and fishermen. Their history in this country goes as far back as three hundred years before Christ. The Batavians came down the Rhine two hundred years after, or one hundred years before Christ; and although they were likewise herdsmen, they occupied themselves more particularly with hunting and fishing.

The lands of the Friesians comprised the whole country to the north of the Rhine as far as the shores of the North Sea, to which West and East Friesland belonged, composing the present Dutch provinces of Groningen, Friesland, Drenthe, and North Holland, besides the provinces of Utrecht, Overyssel, and a part of Gulderland and South Holland. Of all these provinces, Groningen alone appertained to East Friesland.

Tacitus says of the Friesians and Batavians, "They owned cattle not excelling in beauty but in number." He further states, as does also Julius Cæsar, that the Friesians and Batavians paid each other in cows, sheep, and goats, and gave likewise to their children, as dowry, oxen adapted to the yoke and plow, cattle, and horses. When they were subdued by the Romans in the first centuries of our era, the conquerors derived much advantage from this wealth in cattle, and imposed upon the Friesians an annual tribute, consisting of cowhides and meat, while they chose their most valiant warriors from among the Batavians.

The Friesians and Batavians applied themselves to the draining of their marshy lands and their islands; created meadows on the reclaimed soil, while the first protected against inundations by raising hills, breakers, and dikes, of which the traces are everywhere discernible along the coast throughout West Friesland and Groningen. Something is even known regarding the color of their cattle, namely, that they held those of a white color in religious veneration.

It is a very plausible theory that the Friesians, who, at as early a date as three hundred years before Christ, peopled the north of the present Netherlands, and wrought those alluvial plains of Scandinavian clay into soil fit for the requirement of their cattle, did, in after centuries, spread themselves in more northerly and easterly directions as far as the Elbe; as we already know they did, in the fifth century, unite with the Jutes and Anglo-Saxons in emigrating to England; in addition to which, we must observe that these were probably East Friesians and not West Friesians.

The East Friesians from Oldenburg and the country near the Elbe, both south and north of that river, were compelled, through the inclemency of those regions, then in their original condition of low, alluvial swamps, inundated at every tide, to desert them. It was owing to these local circumstances that the Romans were prevented from endeavoring to land their army.

It can be shown that the inhabitants of this territory were unable to make sure provision for their own wants, because of the robberies and piracies committed by the Normans, dwellers on the west coast of Denmark, people from Holstein and Sleswyck, Jutes and Angles. These were by no means peaceful breeders of cattle, as were the Friesians and Batavians, whose land they constantly plundered and laid waste, burning and ravaging their possessions, massacreing the inhabitants, making them pay tribute, penetrating far inland to the mouths of the Rhine and Yssel, and everywhere giving unbridled vent to their ferocity and love of plunder. This was between the eighth and eleventh centuries. Giving due weight to these statement, which, from the nature of the case, must necessarily be brief, it cannot be doubted that the cultivation of cattle in the Netherlands existed a long time before such a thing could ever be thought of in Holstein. It is also quite as certain that the colonists from Friesland, Holland, and Westphalia carried with them their cattle to Holstein.

Hence we see that, first, the Dutch race of cattle date from an older descent than those of Holstein, while, probably, second, the Holstein cattle originated from the Friesian breed, and from that of the Dutch and Westphalian emigrants.

After this colonization, we have our attention directed to another remarkable particular in the history of the Dutch cattle-cultivation. The "Herdbook," unable to maintain the

priority of the name Holstein from an earlier history of Holland and Holstein, might then, perhaps, seek its testimony in a later period, and the events to which your attention is now called.

From the fourteenth on till the eighteenth century a large number of Danish oxen were annually turned for pasture into the grassy meadows of North Holland, formerly West Friesland, and sold at the weekly North Holland cattle-market. The oldest of these cattle-markets is that of the city of Hoorn. This market was already established in 1311, and, in 1389, the Danes and inhabitants of the Eyder were allowed by Albrecht, duke of Bavaria, to hold a weekly market there. In 1605, the Danish cattle-market was removed from Hoorn and transferred to Enkhuyzen, where, in 1624, the number of 1,179 oxen were sold.* There was also in Amsterdam a lean-cattle market, beginning in the spring, in the month of April, but held at irregular periods, depending upon wind and weather, when cattle were allowed to be conveyed from Denmark and Holstein hither to graze. These were mostly brought by vessel.†

These importations of Danish and Holstein cattle into North Holland, to which the "Herd-book" might refer, did not consist of heifers, as stated on page 41, but of lean oxen, which were pastured on the fertile meadows of the Polders, and afterward sold at the markets of Hoorn, Enkhuyzen, and Amsterdam as fat cattle. As to heifers, either then or now, having been imported from Holstein into Friesland and North Holland for breeding purposes, no such thing is known.

To withhold nothing and to put nothing in a distorted light, I may add that in the middle of the eighteenth century several importations took place into Friesland of Danish cattle, consisting of young calves. This was at the time of the raging of the cattle-plague, which desolating disease carried off thousands of the finest cattle in Friesland and Holland.

For the purpose of keeping the cattle-trade alive, and to fill the places of those destroyed by the plague, small Danish breeds and German cows of a diminutive size were substituted and crossed with the remaining and recovered natives.

"They were," says Scheltma,‡ "Danish-Holstein and small German cows, of which the greater part were smaller in size than the native race." In the same work we also find "that one was reduced to the necessity, in 1769, of purchasing the needful cattle in the county of Bentheim, in the districts of Oldenburg and Munster, in Hanover, and other parts of Germany."

In the work "Present State of Friesland," it is mentioned that, "owing to the cattle-plague, the people were compelled to import from abroad all kinds of *small* cattle, chiefly Danish. But, what was remarkable, however small and ill-favored these animals might be, when compared with the handsome Friesian horned cattle, as a natural consequence, an improvement of food induced a favorable development of body, and, from the mixture of the two breeds, good and choice milch-kine were attained within two or three generations of the introduction of the foreign blood, no matter how much the race had in the beginning deteriorated through the process, and, eventually, the type of Danish and German cattle was quite lost. This is, however, already one hundred years ago.

A fair consideration of what has been thus far stated will leave no justification of the "Herd-book's" imputation upon the antiquity and purity of descent of our Friesian or Dutch cattle, or its assumption that they are of Holstein origin. No; the genealogy of Netherland cattle is pure and unadulterated, and it is at least two thousand years old.

I come now to the present time, and the question whether it is tenable to give to one variety of cattle the name of an entire group, and to reckon as appertaining to it all its several varieties or breeds, as, for instance, the Dutch, Friesian, Oldenburg, Holstein, &c.; and would it not be imperative in such a case to give it the purely historical name by which it is generally known? If it could be desirable to give a general name to the cattle of the just-mentioned districts, then that of *Holstein cattle* would not be appropriate, and for it should be substituted that of *Friesian cattle*, whence all the varieties originated.

The chief characteristics of this Friesian breed—its eminent milk-giving and fattening qualities—we find in all the just-mentioned districts, and extending still farther southward, with this difference, however, that wherever the land is more fertile, the climate milder, and the tending, feeding, and breeding of the cattle observed with more care, in that measure, and according as these requisites stand to each other in the closest proportion and harmony, they are more developed, attain larger size, and are of a finer texture.

If the intention be to convey a correct understanding of the true qualities of the several varieties or breeds mentioned in their own dwelling-places, it is better that each breed should retain the name by which it is known, and that no collective name, though an historical one, should be given them.

In order to be able to readily classify a group of cattle of great extent, possessing the same chief qualities in form and productiveness, Strum § proposed, so long as fifty years ago, to give to a group, subject to the same conditions of soil and climate, a name indicating those conditions, and thus originated the designations "mountain cattle," "highland cattle," and

* G. J. Hengeveld, Cattle, Vol. II, and G. Brank, History of Enkhuyzen.

† T. Domselaer, Description of Amsterdam, 1655, Vol. III, p. 194, and Vol. IV, p. 237.

‡ B. C. Scheltma. Treatise of the Society for the Promotion of Agriculture, Vol. XV, P. 2, p. 3. Compare also "Cattle," Vol. II, p. 61.

§ Dr. Strum: Of Races. Crossing and Improving of Indigenous Domestic Animals. Elberfeld, 1825.

"lowland cattle." He also heads each of these divisions by the breed best representing the distinctive feature of its class, *as its type*. It is under the denomination of lowland cattle that he places the different breeds of cattle of the coast-lands along the North Sea. Schmalz, Pabst, and many subsequent writers, adopt this classification—some with a few modifications; but all find in the physical characteristics of the country to which they are indigenous, the general denomination of the collective group. According to Schmalz's statement, cattle, adopting Strum's classification, may be distinguished in the following manner:

A. *Lowland Race.*—Primitive cow; Dutch Friesian cow.

B. *Mountain Race.*—Degenerate; quite the contrary of A; Swiss cow.

C. *Middle Race.*—Highland race; forms the transition from A to B; Frankish cow.

On page 55, Schmalz says, "To the race A belong the *Dutch, as representative*, the Friesian, the Oldenburg, and chiefly all lowland races, bearing the peculiar characteristics which identify it with the place of its sojourn.

"This is a purely natural division, and there is not the least arrogance in asserting, what history points out, that the Dutch cattle constitute the type of the oldest, purest, and best breed. All other varieties are of less intrinsic value; they are coarser or smaller, possess less productive qualities, though of local excellence in their native places.

"*If cattle of the genuine breed are bought, imported elsewhere, and there bred, why is it not called by its native name, and why must an appellation be given to it quite foreign and unknown to it?*

"One hears in Europe of 'lowland cattle,' but purchases of them for the purpose of improving other breeds have, for the last hundred years, been only made in the chief Netherland provinces, where the choicest cattle of the lowlands are found. Thus, thousands of Dutch and Friesian cattle are annually sent abroad under the name of *Dutch cattle*."

Finally, I beg to add quotations from Dr. George May,* director of the agricultural establishment at Weihenstephan, who visited Holland about ten years ago.

"The Dutch cattle constitute the type of the properly so-called lowland race, which extends throughout Netherlands, Flanders, Normandy, Oldenburg, and Denmark." Further on, page 41, he says: "The Oldenburg cattle descend from the Dutch race, and are likewise distinguished as East Friesian cattle, as still partially found in Hanoverian Friesland. In the adjacent parts of Bremen it is called Bremen cattle." On page 42: "The Holstein and Breitenburg cattle in the Wilster and Rempner marshes are equal to, * * * but with respect to their square build, the Breitenburg cattle are, in their properties, more like the finer Dutch cattle."

Other writers of repute may be quoted, but enough has been given to show that the name of "Holstein cattle" is only a local and not a collective name, and may not be given to cattle bought in North Holland; to do so is to underrate the Dutch cattle race.†

Trust in the love of truth and fairness of the American breeders of Dutch cattle induces me to believe they will yet give to that race the name which is their due; that the appellation "Holstein herd-book" will be abandoned, and that we shall have, in its place, the Holland herd-book.

Here, esteemed sir, I conclude my lengthy epistle, and apologize, at the same time, for the liberty I take in troubling you with my views in a somewhat tedious strain; but the honor of our Netherland cattle seemed to call for a word in its defense. Besides, I suppose, there are breeders found in Massachusetts who by no means approve of the name given by the gentlemen of the "herd-book" to our cattle, as is evident to me from some of the numbers of the "Massachusetts Ploughman," and from which I have reason to infer there are interests at stake involved in the name, of which I do not wish to judge.

With sincere esteem, I have the honor to be, yours truly,

G. J. HENGEVELD,
Teacher of the Netherland Royal Veterinary Institute.

Mr. CHARLES MUELLER,
United States Consul at Amsterdam.

NEW JERSEY.

The first annual report of the New Jersey State Board of Agriculture contains the law under which it was established, the by-laws and general plan of work adopted, the names of the officers and members of the board, reports from a number of county and district societies, essays on various subjects of interest to the farmers and fruit-growers of the State, analyses of soils and fertilizers, and the business transactions of the board for 1873.

* Dr. George May. The Cattle, Munich, 1863, vol. ii, p. 38.

† Instances of the misinformation and confusion growing out of the present attitude of the "herd-book," may be found in Nos. 2, 3, and 18 of that register. The two former are Breitenburg cows, and the latter an Oldenburger, both of races distinct from and inferior to the Dutch.

The first meeting of the board was held at the College Farm, New Brunswick, September, 1872, when a permanent organization was effected by the election of Joel Parker as president and Prof. George H. Cook as secretary. At the second meeting of the board, held at Trenton, March 5, 1873, by-laws for the government of the board and a plan for its future operations were adopted. In addition to an annual meeting for the transaction of business, the board agreed to hold two additional meetings during the year, one in the spring and the other one early in autumn, for the purpose of considering matters relating to the progress of agriculture and the advancement of farming interests. The following standing committees were provided for: A committee of three on the culture of staple crops; a committee of the same number on horticulture and floriculture; a like committee on forest culture, and one on the diseases of cattle. An executive committee, consisting of five members, was also provided for.

The third meeting of the board was held on the grounds of the State Agricultural Society at Waverly, September 17, 1873. This was a joint meeting of the officers of the State Agricultural Society and of the State board, but no business of importance was transacted.

The secretary, in his admirable report to the board, says that the State was originally settled by farmers. Descendants of the Hollanders from New York and Long Island settled in Hudson, Bergen, Morris, Passaic, Somerset, Hunterdon, Sussex, Warren, Monmouth, and Middlesex counties. Those of English parentage, from Connecticut and Eastern Long Island, settled in Essex, Morris, Union, Somerset, Hunterdon, Middlesex, Monmouth, Ocean, Burlington, Atlantic, Cape May, and Cumberland counties. English settlers located in Salem, Gloucester, Camden, Burlington, Mercer, and Union; Scotchmen in parts of Middlesex and Monmouth; Swedes in Salem and Gloucester; Norwegians in Hudson and Bergen; Welsh in Monmouth, and Irish and Germans in Warren and Sussex. The State, in size, is thirty-fourth in the list of thirty-seven States. It stands twentieth in the yearly value of its agricultural products, and twenty-sixth in the number of persons engaged in agricultural pursuits. In mining products it is the eleventh, in manufactures the seventh, in wealth the eighth, and in population the seventeenth in the Union. As stated in a previous report, the value of its farm-lands is greater, by the acre, than those of any other State. The mixed industry of the people, together with the nearness of the great markets of New York and Philadelphia, cause the products of the soil to bring extraordinary returns.

Accompanying the report of the board is an excellent map of the State. It is colored geologically, so as to exhibit the location and arrangement of the different rocky and earthy formations in the State; and, since the soils have been mainly formed by the crumbling or decay of the rocks on which they lie, the map gives a general and distinct idea of the several characteristic classes of soil in the State. Some members of all the great geological formations are to be found in New Jersey, except that which contains coal. The secretary says that the production of earth and soil, directly from the rock, can be distinctly seen in many localities. Along the line of the New Jersey Central Railroad, from Lebanon to Hampton, in Hunterdon County, remarkable examples of the change from rock to earth are to be seen. This is also the case between Annandale and High Bridge; between Lebanon and Clinton, at Chester, and over a large space near New Brunswick. In other localities, the northern drift, which has swept over the whole surface, has carried much loose material from one formation to another, and has

mixed up the different earths so as to almost entirely change their original character. The washing of water, at some early period, has also sorted the materials in some places, leaving the gravel by itself, the sand in banks or beds by itself, and the clay, or finest part, in still another place. Speaking of the usual expressions to indicate the character of different soils, the secretary says:

> The old method of classifying soils, as sandy, loamy, or clayey, is only a statement of their mechanical condition. In the northern part of the State they are so much stiffer and heavier than in the southern part, that what in the former would be called a sandy soil would be called a clayey soil in the latter; and so great is the change made by drainage and the removal of water, that ground which, before it was drained, was thought to be clayey, has proved after drainage to be a light loam in all sections of the State. These old terms will, no doubt, always be used to express the condition of land as to dryness and moisture and perhaps as to fineness, but they give no indication of the quality of the soil or its fertility.

Prof. Cook is of the opinion that, with our present knowledge, analyses of soils can be of no practical value in instructing the farmer as to the wants of his land and the speediest way of restoring its fertility. It is almost impossible to judge from the analysis of a single soil what its deficiencies are, or what fertilizer it needs to make it productive. So many circumstances affect it besides its chemical composition, that a knowledge of that alone will be of little avail. The particles of soil must be fine and loose. There must be an open and well-drained sub-soil. There must be at least a moderate supply of vegetable matter in the soil. There must be a sufficient amount and not too much moisture at all times. Wanting any of these conditions, and there can be no satisfactory crop, however rich the soil may be, and yet none of these singly can be taken as a basis for a system of agriculture. They are all necessary adjuncts, but do not occupy so important a place as do the elements of the soil themselves.

Prof. J. C. Smock contributes a paper on the cultivation of the locust-tree for timber. He states that there are two varieties of this tree in New Jersey and on Long Island—the white and the yellow locust, so called from the color of the heart-wood. The yellow variety produces the most durable wood, and for that reason is regarded as the most valuable for timber. The cultivation of the tree is most profitable upon rich and loamy soils, or at least upon soils underlaid by a good subsoil. On such lands it grows very rapidly, and is less liable to attacks from the borer. Its rapid growth is especially noticeable in the greensand districts of the State. The red-sand bed of the same geological formation also appears favorable to its growth. Under favorable conditions thirty years will produce trees 50 feet high, having a trunk from 18 to 20 inches in diameter. Upon rich bottoms, where the trees grow rapidly, they may be cut when thirty years old, although they will continue vigorous until forty and even sixty years old. The yield of wood, however, is greater when the cuttings are at intervals of thirty or forty years than from longer growth.

The cultivation of the locust in New Jersey has been limited to the central and southern portions of the State. The largest and most thrifty groves are to be seen in Monmouth County, in the townships of Holmdel, Atlantic, Marlborough, and Freehold. One of the largest and oldest of these is on the farm of Mr. W. H. Hendrickson, near Middletown, in that county. It occupies the site of a native forest, the trees of the latter having been thinned out so as to allow the growth of the locust-sprouts set out among the younger trees of the woods. Growing up with these the locusts branched but little, and the stems are very straight and tall. On the same farm there are about twenty

acres exclusively in locust timber, about twenty-five years old, where tilled ground was set with the sprouts from the older wood. These trees are about 10 feet apart and from 40 to 60 feet high, measuring about 8 inches across at the ground. Near the Mansion House there are two trees sixty-seven years old, whose greatest diameter is 2½ feet. Other large and thrifty groves are to be found on the farms of Mr. Lafayette Schanck and Mr. Isaac G. Smock, in Atlantic Township. On the farm of Mr. J. F. T. Forman, near Freehold, there are two hundred trees, grown from seed planted in 1835 and set along the road at intervals of 4 feet, which will average 5 feet in circumference, measured near the ground. Some of them are estimated as large enough to cut thirty posts each.

The greatest use of wood from these trees is for fencing-material, either as posts or stakes. Cuts for posts vary from 7¼ to 7½ feet in length, and are at least 6 inches in breadth. They should be two inches thick at the top, and from 2 to 3 inches at the bottom. To furnish such a cut the log must be 6 inches across. A large tree will allow from four to six cuts, and of these the first may be large enough to make seven or eight posts; in all at least twenty posts. Holed posts are valued at from 50 to 75 cents apiece, garden-fence posts 25 cents each, fencing-stakes at 5 cents apiece. From these figures Professor Smock estimates the profits of an acre of locust timber as follows:

Assuming that there are five hundred trees on an acre, (and this is not a high estimate,) and that these are large enough to make twelve posts each, worth 50 cents apiece, the aggregate amounts to $3,000. A grove of quite large and thrifty trees, thirty-six to thirty-eight years old, but not so close as the above, on the farm of Daniel Coon, near Holmdel, cut off two years ago, averaged sixteen hundred fence-posts to the acre, which sold at 75 cents each, making $1,200. Instances are known where six hundred fence-posts have been cut from an eighth of an acre, which is equivalent to four thousand eight hundred, or $2,400 per acre. These figures are based upon a growth of thirty years. Gross returns at the rate of $2,000 per acre are not uncommon in Monmouth County. From this must be deducted the cost of planting and the expenses of cutting and preparing the timber for market. These items of expense are in part paid by the smaller posts, stakes, and fire-wood, and sometimes by the pasturage afforded during the later years of growth.

Thus far the locust has been considered as valuable for fencing-timber, but the same admirable qualities which fit it for this purpose render it equally desirable to ship-builders and to all needing a strong and durable wood. Its high price has prevented a more extensive use. In durability it is almost unsurpassed, lasting in the form of fence-posts a generation at least. It is also the strongest of all our woods, equaled only by some of the more valuable foreign woods, as lance-wood and the mahogany. With the strain or tension in the direction of its fibers, it will hold nearly double the weight supported by the chestnut, and 50 per cent. more than the oak. Tried transversely or across the fiber, its resistance is greater than any of our native woods, being to that of the oak as 100 to 75. The locust is also more elastic than the oak. On account of its density and durability, the locust would make the best of railroad-ties, lasting three times as long as the chestnut or oak, now so generally used. At present the price is too high for such uses, but it is to be hoped that the extension of our locust-area will soon meet the large demand of our railroad companies, now so rapidly devouring our native forests. The combined qualities make it our most valuable timber, and one that ought to be used in many places where we now employ oak, chestnut, hickory, and other inferior sorts.

Professor Cook gives the following directions for planting and propagating the locust as a forest tree:

The propagation of the locust may be by planting the seeds or by transplanting the sprouts or suckers, which are always to be had near old or large trees. If the seeds are to be used, it is advisable to soak them in hot water before planting, as this hastens the sprouting. Thus prepared, they may be sowed early in the spring, in drills three feet apart, allowing 4 or 5 inches between the seedlings. During the first season these will attain a height of from 6 to 15 inches. They may be transplanted the second summer to their permanent location. Sometimes the seeds are sown on the ground where they are to remain, thus avoiding transplanting. The plants from the seed do not grew so rapidly or vigorously as the sprouts from the stumps of a previous generation, and the abundance of such sprouts generally suffices for the demand without planting the seed. It is advisable to plant close, as a thick

growth furnishes a taller trunk, and the borer is not so destructive in a nursery or grove as in the case of trees standing alone, sunlight appearing to favor the depredations of this insect. If too close, however, some will die, and so create unequal gaps; or, if living, the trees are apt to grow too spindling and are easily broken down by the wind. Intervals of from 6 to 10 feet between the trees appear to be the best. The sprouts should not be set out in woods or in newly-cleared grounds where other native and more hardy trees are to grow with them, as some of these soon outstrip and shade them, unless great care be taken to thin out and keep down the more rapidly-growing forest-trees.

A committee appointed to investigate and report upon the introduction of *pleuro-pneumonia* among the cattle of the State, and to devise means for the extirpation of the disease, if possible, find that it was introduced into this country in 1850, when a cow was brought over from England as a ship's cow, and sold to a German, near South Ferry, Brooklyn.

This cow was transferred to a herd in Skillman street, in that city, where it shortly after died of *pleuro-pneumonia*, imparting the disease to the whole herd. The contagion at once spread through the herds of Brooklyn, Long Island, Westchester County, and some herds in New Jersey. With brief intermissions, the disease has since prevailed in various sections of the State, occasioning an annual loss of many hundreds of valuable cattle. The committee regard the disease as highly contagious, and suggest means for preventing its spread beyond infected herds.

They give the following diagnosis of the disease:

The first symptoms of pleuro-pneumonia seldom attract much attention, and the disease commonly steals on without manifesting any great violence; the animal appears dejected, and, when in the field, separates itself from its fellows, often getting behind a wall, hedge, or other shelter to keep out of the wind. As the disease progresses, it becomes uneasy, loses its appetite, and stops chewing the cud; the eyes appear dull, the head is lowered, the nose stuck forward, the nostrils expanded, and the horns and skin are warmer than common. With failure of the appetite, thirst may continue and increase. In cows, the milk falls off, either gradually or altogether. It is seldom that the first progress of the disease attracts much notice until the animal stops eating. Cough, although frequently accompanying the disease, is by no means a constant symptom. When, however, the pleura or lining membrane of the windpipe or the bronchial tubes become inflamed, loud and harsh coughing is a never-failing symptom. Pressure between the ribs and along the spine causes the animal to wince. The breath grows warmer and often fetid, the danger rapidly increasing, of course. The animal will often press her muzzle very hard against the partition, as if for support, will breathe with great difficulty, and soon dies. The progressive symptom varies greatly, however, in different animals, but the cough is the key-note of the disease, and appears in all. There can be no longer room to doubt that the disease is contagious or infectious. It seems to be communicated by animal poison in the air, proceeding from the lungs and breath or respiratory surfaces of a diseased animal, and any animal of the same species, coming in contact or within the influence of this vitiated air, is very liable to be infected.

An association composed of those interested in the growing of cranberries was organized at Trenton, April 25, 1873. Rev. J. H. Brakeley, of Bordentown, was elected president, and Mr. James A. Fenwick, and Dr. E. S. Merriam, vice-presidents, with Mr. W. S. Johnson, as secretary. These officers, with the addition of Mr. E. W. Crane, constitute the executive committee of the association. An additional secretary was also appointed for each county interested in the growing of cranberries. It was provided that the annual meeting of the society should be held at Trenton on the third Tuesday in January, and an annual convention on the first Tuesday in September, at some place previously designated. The beneficial effects of this association are already being felt. Three well-attended meetings have been held, at which scientific and practical papers on the culture of this fruit were read, which were followed by discussions of great interest to the cranberry-growers of the State.

The following detailed account of the organization, work, and aims of the association is furnished by Mr. E. W. Crane, of Essex County:

There had been, previous to the meeting at Pemberton, two organizations, called respectively the New Jersey Cranberry-Grower's Association and the Cranberry Union. The ob-

jects of both being similar, they were consolidated under the name of the former, "New Jersey Cranberry-Growers' Association."

We have succeeded beyond our anticipations. The reform in packages was much needed, for cranberry boxes and barrels were very much like peach-baskets and pieces of chalk, extremely variable in size. The standards adopted are, a barrel of three bushels, a crate of one bushel; also a smaller crate of one peck. All of them, when properly filled, hold the quantities named, rounded measure, the "round" consisting of three and a half quarts more per bushel than "struck" measure. The barrel is the same as that adopted as a standard by the Cape Cod Cranberry-Growers' Association, which secures uniformity where they come in competition. It is made of 28½-inch staves, so jointed as to give a bilge of 7½ inches, head 16⅛ inches diameter, and so set in staves as to leave the inside measurement 24⅜ inches; and the finished barrels are about 28 inches in height. The one-bushel crates must measure inside, exclusive of middle partition, 8⅜ inches, by 12 by 22 inches, equal to 2,211 cubic inches. The one-peck crates must measure inside 4 inches by 8⅜ inches by 11 inches, equal to 552¾ cubic inches.

These packages are all made by manufacturers, who apply to the standard-measure committee for the official brand of the association, are furnished the necessary directions, and agree to brand or stamp only standard sizes, holding them at all times subject to the inspection of the committee, who are charged with exposing all cases of fraud brought to their notice, both through the press and by circulars sent to parties interested.

The sizes have been sent to both growers and dealers, so that all may know them, and fraudulent sizes, if any are made, can at once be traced to the maker by the simple arrangement of having the initials of each manufacturer on his own brand, and there are no regular brands without these individual initials cast with the others, as it consists of those of the association with those of the manufacturer underneath, in smaller letters, and between two arrow-heads, thus:

{ N. J. C. G. A. }
{ ←A. V.→ }

D. T. STANIFORD, New Egypt.
E. W. CRANE, Caldwell.
Hon. W. S. JOHNSON, Trenton.

The initials on the left are those of the association and the manufacturer, and the names on the right are the names of the gentlemen composing the standard-measure committee. These brands are furnished only by the committee, and a record of them is kept and published.

OHIO.

The twenty-fourth annual report of the Ohio State Board of Agriculture for the year 1872 is a finely-printed and elegantly-bound volume, of about seven hundred pages. It was compiled and printed under the direct supervision of Mr. John H. Klippart, secretary to the board, who also contributes several valuable papers, which add additional interest to the work. The volume is a valuable contribution to the agricultural literature of the year, and does great credit to the society from which it emanated. It contains the proceedings of the board and the business transactions of the society for the year; the list of premiums offered and awarded at the twenty-third annual fair; the proceedings of the twenty-eighth annual convention of the society, held at Columbus on Wednesday, January 8, 1872; abstracts of reports from a large number of district and county societies; an essay on the subject of "Fish-culture," from the pen of Mr. John H. Klippart; also essays on the following-named subjects: "The potato-disease," by Worthington G. Smith; "The potato blight and rot," by Thomas Taylor; "Blight of the grape," by J. Brainard; "Plans and specifications for arrangement of home grounds," by F. R. Elliott; "History of the Percheron horse," by John H. Klippart. In addition to these articles the report contains the proceedings of the National Short-horn-Breeders' Convention, held at Indianapolis, Ind., during the latter part of November, 1872; the report of the secretary of the Ohio State Horticultural Society for the year 1872-'73, and a number of selected articles of great interest.

At the annual convention of the society, which assembled at Columbus

on the 8th of January, the following-named subjects were ably discussed by the delegates in attendance:

1. Organization and management of agricultural associations.
2. Distribution of forest-timbers.
3 Necessity of legislation with a view to secure more equitable charges for the transportation of products on railways.
4. That organizations promotive of the agricultural interests shall be recognized in the State constitution to be made in 1873.
5. Legislation for the protection of farmers and their property from trespass by hunters and their dogs.

Dr. J. A. Warder, on opening the discussion on the subject of the distribution of forest-timbers, said:

I hold that forest-trees should be planted generally. They should be generally distributed all over the State. There should be some timber-lot on every farm. Forest-trees should be planted especially upon waste and hill lands, and also in open countries, so as to serve as wind-breaks on the exposed sides of the cultivated lands. Why so? you may ask. First, they should be planted upon every farm, for the convenience of the farmer and for his domestic uses in a thousand ways. Secondly, they should be planted on every farm for the protection of the farmer, his cattle and his crops against the effects of sweeping winds. Thirdly, they should be planted upon every farm for the sake of their valuable influence in equalizing the temperature and dryness of the atmosphere. Fourthly, they should be planted on almost every farm—certainly on every farm in the part of the State which I represent, where the ground is more or less broken—for their influence in preventing the washing away of the surface of our soils. This applies to broken or hilly lands; also on the margins of streams. Lastly, particularly where the soil is thin, it should never have been cleared; and, if cleared, should at once be replanted in forest-trees. In doing this, we may find it evidently an advantage to replant with better and more profitable or more valuable kinds than those which come to us from the hand of nature.

In order to bring the subject properly before the convention, Dr. Warder then submitted a series of resolutions, which, after some debate, and the adoption of one or two unimportant amendments, were adopted as follows:

Resolved, 1. That we urge our brother farmers and land-owners in all parts of the country to plant their hill-sides, ravines, and broken or rocky grounds with forest-trees.

2. That we believe that at least one-tenth of each farm should be planted with groves and shelter-belts of timber-trees, deciduous and evergreen.

3. That agricultural societies be urged to offer suitable premiums for the encouragement of tree-planting and nurseries of trees.

4. That the State legislature be requested to encourage the planting of artificial forests and setting trees along the sides of all highways and railroads, and also that they be urged to pass more stringent laws for the protection of forests from destruction and damage by fires, especially those caused by wantonness, and by locomotives.

5. That we respectfully ask the statesmen of our land in Congress assembled to foster and encourage the enterprise of private citizens who may give assurance of their ability to demonstrate the important problem of planting artificial forests on the great western plains, and that a sufficient grant of land be made to them for this purpose.

6. That we ask the Congress of the United States to require, so far as is practicable, that railroad companies and settlers receiving the benefit of the homestead and other acts donating lands, shall plant a due proportion of such lands with useful timber-trees.

7. That we urge the institutions of learning established under the agricultural-college land-grant act to give special attention to the cultivation of trees in illustration of their teaching of forestry.

8. That we ask the railroad companies, whose necessities have led to the destruction of so large an area of our native forests, to co-operate with us in restoring the timber-growth, and that they shall provide for the planting of such lands as may be at their disposal and adapted to the growth of forest-trees. And further, that we urge them so to modify the construction of their locomotives as to avoid the wide-spread conflagrations for which they are responsible.

Mr. S. D. Harris, of Cleveland, read a paper on the organization and management of agricultural associations. After alluding to the annual exhibitions of these associations, and their liability to failure on account of bad weather and other unfavorable circumstances and unforeseen difficulties, he says:

There has been inaugurated within a few years a system of more permanent expositions, covering a much longer space of time, and, by the use of extensive and substantial build-

ings, securing the goods on exhibition from all stress of foul weather and the visitors' inconvenience by both foul weather and an uncomfortable press of people at any one time. Of course this exposition system is only applicable to large cities, but where it can be put into operation it has so much to commend it, and, with so few of the natural drawbacks always attendant upon these occasions, that I feel constrained to urge it upon the attention of all whom it may concern. The grand expositions at Cincinnati, the last two seasons, have exceeded in extent, variety, and excellence, any similar fair of the American Institute in New York, while the like expositions, held last season in Louisville and Memphis, are worthy of all commendation. * * * In the matter of comfort, satisfaction, convenience, and economy, the permanent-exposition system has every advantage over the four-day out-door system. In the four-day system we have really but two show-days; then come the hurry and scurry, the haste and waste of going to the fair. Railroad trains are overloaded, off time, wrecked, people killed; the articles for exhibition are only fairly in place before the time for their removal. People are excited, and in the throng of the occasion do not see half there is to be seen, or see well what they do see. Hotels are overcrowded, and discomfort and extortion are the consequence. People are in a stew from the time they leave home till they get back, and protest they will never go to such a place again.

Now, the fault is in the system, and not in the thing itself. Under the more permanent exposition system, the articles are in place when the show opens, advantageously arranged for inspection, and secure from the ravages of the storm and the gentle violence of the sun. Visitors can club together by neighborhoods, for company's sake, and choose any day in the range of four or five weeks, when it will suit their convenience to attend; they get excursion rates on the railroads, and are not obliged to pay extortionate prices for the privilege of discomfort at hotels; they see everything at their leisure and at best advantage; they go home satisfied, and say they will go again next year.

In the course of a paper on the subject of transportation, and in support of the proposition that excessive rates of transportation greatly impair the value of the articles produced in the hands of the producer, Mr. J. M. Millikin said:

There can be no controversy about the fact that excessive charges for the transportation of the productions of the farmer greatly impair the value of the articles produced in the hands of the producer. As a consequence, the aggregate amount of production will become greatly reduced, and will neither keep pace with our rapidly increasing population nor the daily enlarged capabilities of our farming population. These positions seem to me to be abundantly sustained by reference to our aggregate productions in the two years of 1860 and 1870. I have already given you the facts in reference to a certain class of our productions for the year 1870, and I now propose to compare them with the same products for 1860:

	Head.
We had of cattle, sheep, and swine, in 1860	81,600,000
We had, as before stated, of same animals in 1870	78,000,000
Amount of decrease in ten years	3,600,000
	Bushels.
We produced of wheat, corn, rye, and buckwheat, in 1860	1,050,468,000
We produced of the same in 1870	1,075,489,000
Excess of production of 1870 over 1860, say	25,000,000

The falling off of domestic animals in the ten years was 3,600,000 head, a decrease of 4½ per cent. The increase of grain in ten years was 25,000,000 bushels, an increase of 2½ per cent. The per cent. of decrease in stock within the decade is much greater than the increase in grain. If a comparison of values should be made, it would be found that the difference would be in favor of 1860, and that the aggregate of domestic animals and grain in 1860 exceeded the aggregate in 1870; in other words, our products have actually decreased during the last ten years.

And now, what of our population? It has increased from 31,443,000 to 38,553,000, being a clear increase of 7,110,000, or 22 per cent. May I not ask why is it that while our population, under so many exceedingly depressing and adverse circumstances, during ten sad and perilous years of our existence, has increased more than seven millions, that in the same time our agricultural products have not increased in quantity nor advanced in price? With more than an average foreign demand for our productions for the last six years, and a continually growing disproportion between our supply and the number of our consumers, why is it that the value of provisions is less in value even to-day than in 1860? Why is it that the average price of mess pork, in the city of Cincinnati, for six consecutive years from 1855, was over $17 per barrel, while to-day it is worth only $12 per barrel? In 1860, and in the five previous years, we had from seven to nine millions less of population than we have now, and we had over 9,000,000 head of cattle and hogs more than in 1870; and yet the prices for pork was 40 per cent. higher than at this time.

Mr. John Hussey read a very interesting paper on the subject of forest-distribution. In the course of his essay he alluded to the prevalent idea that it takes so long to reproduce our best timber-trees that many are deterred from planting them. It may be true that the man who plants an oak or a walnut will not live to see it become a very large tree; but the very fact that two or three centuries have passed since a tree began its career of growth ought to be a sufficient reason why a man should hesitate to destroy its life without sufficient cause. There are comparatively but few trees standing which had commenced to grow when the continent was discovered in 1492. The greater part of the trees in our forests are less than three hundred years old. It takes about two and a half centuries for the best hard-wood trees to reach a diameter of 30 inches, allowing variations for species, soil, and locality. It is probable that a plantation of oak or walnut, ash or chestnut, well cared for and kept properly thinned out, would reach nearly this size in two hundred years. But they are valuable for many uses at all stages of growth. A plantation of white-oak or hickory, chestnut, walnut, or black-locust will always furnish sticks of value for countless uses from the third or fourth year of its existence. The necessary thinning out will be a source of profit in the way of hoop-poles and vine-stakes which always have a constant market.

Mr. John H. Klippart contributes a paper containing a vast amount of statistical information relating to the subject of the fish-trade and the progress of "fish-culture" in Ohio. He states that every county in the State, without a single exception, has a sufficient amount of water in the streams within her territory to grow all the fishes required for food by the people of the county. A summary of the area drained by the several streams of the State is given as follows:

I. The Mahoning and its tributaries drain an area of fully two thousand square miles in Ohio;

II. The Maumee and its tributaries drain a territory of fully five thousand square miles in Ohio, besides many square miles in Michigan and Indiana;

III. The two Miamis and their tributaries drain a hydrographic basin whose area is at least six thousand square miles;

IV. The Scioto and tributaries drain fully five thousand five hundred square miles;

V. The Hocking and branches drain one thousand five hundred square miles; and, lastly—

VI. The Muskingum and its many tributaries, spread over nearly one-fourth of the State, drain an area of eight thousand five hundred miles.

In addition to the large area drained by streams, there are a number of reservoirs in the State, which were constructed to insure a supply of water for canals, and which are fed by springs, rivulets, or small streams. These reservoirs being located on the water-summit in their respective regions, the water besides being ample in quantity, is necessarily good and pure, because the springs or sources of supply are in no case at any considerable distance from them, and hence do not bring down from greater elevations foreign or injurious matter to impregnate the water. The areas of these reservoirs are given as follows, in round numbers:

	Acres.
Mercer County, (15,742 actual)	16,000
Lewistown	8,000
Licking, (3,900 actual)	4,000
Loraine	2,500
Paulding County	2,500
Akron summit, with Rex Lakes, Long Lake and the other smaller ones	2,000
Total number of acres	35,000

This is an area of nearly fifty-five square miles. The writer states that the character and quality of the water in any one of these reservoirs

differ from all the others in a greater or lesser degree. The Summit County, Rex, and Long Lakes are colder, clearer, and more peaty than the others; the Licking County reservoir is fed by springs in the Carboniferous series, and is therefore softer water than those in the western portion of the State; the Loraine, Mercer, and Paulding reservoirs are in limestone regions, and the water there holds lime and other minerals in solution to a greater extent than that in the other reservoirs. With this variety in the quality and characteristics of these waters, it is not unreasonable to infer that there may be grown or cultivated in them a great variety of native or indigenous fishes, together with new and desirable varieties from other States and countries.

These reservoirs, Mr. Klippart states, can be made to yield a net revenue of $10 per acre, or an annual revenue of $350,000 per annum to the State. He gives the average annual consumption of fresh fish by the people of Ohio at 8,514,000 pounds, costing, at 5 cents per pound, the sum of $425,700. Add to this the fish-guano and fish-oil, the dried sturgeon and sturgeons' eggs manufactured into "cavaire," and it will probably exceed an annual aggregate expenditure of half a million of dollars. He says:

The market-master of Columbus has kindly furnished me with the statistics of the fish market of this city, from which it appears that 375 tons of fresh fish are annually consumed in Columbus. Less reliable data indicates that Cincinnati consumes 2,750 tons, Cleveland 1,250, Dayton and Toledo each 400 tons, Sandusky 200, Springfield 175, Zanesville 150 tons. From this data, I estimate the consumption of fresh fish in Ohio at an aggregate of 16,663 tons annually. To supply this demand Ohio has drawn on the waters of other States, the supply in our own being inadequate to the demand. The State having control of the waters within her own boundaries, and as these waters are most admirably adapted to fish-culture, there appears to me no good reason why the State should not adopt measures to insure an adequate supply of fish in our own waters. The fish when in first hands are worth about 5 cents per pound; the aggregate amount consumed in the State will therefore, at this rate, be worth $1,666,250. If the State realized a royalty of $5 per ton only, it would amount to $83,350.

The writer gives the following list of fishes, which if not indigenous, may be profitably raised in the lakes, reservoirs, and rivers of the State:

Perch family.—Yellow perch, pickerel of the lakes, sunfish, rock-bass, grass-bass, black-bass of the lake and black-bass of the Ohio River, (two distinct fish, though bearing the same name,) dwarf bass.

Hog-fish family.—White perch of the Ohio River, sheeps-head of the lake, hog-fish, blenny-like hog-fish, variegated hog-fish.

Carp family.—Carp of the Ohio, mullet of the lake, Missouri sucker, white sucker, red-horse sucker, Buffalo sucker, brook sucker, spotted sucker, mud sucker, white sucker, black sucker, rough-nosed dace, stone-roller, silver shiner, large shiner, red-bellied shiner, red-bellied shiner of the lake, white and yellow winged shiner, horned-chub, red-sided chub, gold shiner, flat shiner, chub-nosed shiner, flat-headed chub, mud minnow.

Pike family.—Muskallonge pike, black pike.

Catfish family.—Blue catfish, yellow catfish, channel catfish, mud catfish, bullhead, yellow backtail.

Salmon family.—Mackinaw trout, speckled or brook trout, shad of the lake, white-fish.

Shad family.—Gold shad, hickory shad, larger herring, lesser herring, moon-eyed herring, dog-fish, duck-bill gar, alligator gar, common gar.

In addition to these we have several species of eels, sturgeon, and other fishes, which have not yet fallen under the notice of the naturalist so as to be properly classified. Out of this list of nearly seventy-five species, according to Professor Kirtland's catalogue, made nearly forty years ago, there certainly must be at least half a dozen species which are as much worthy our care and attention, and whose culture is certainly as profitable as some branches of farming in which millions of capital are invested. For the lake the propagation of white fish, Mackinaw trout, and the lake perch perhaps would pay the best. In the reservoirs and rivers the perch family would in all probability be the most advisable and profitable. It is possible that some species now unknown in our waters, more desirable than any of those enumerated above, may successfully be introduced and cultivated with profit.

Mr. Klippart also contributes a paper on the subject of the origin of the "Percheron horse." He states that Perche, the locality in which this race of horses originated, is comprised in the former Orleanais, and is located in the center of four departments, which concurred in the formation of the circonscription of the depot at Bonneval. The territory was taken as follows: from L'Orne, the arondissement of Montagne, and a part of Alençon; from Eure-et-Loire, the arondissement of Norgent-la-Ratron; and a fraction of those of Chartres, Dreux, and Chateaudun; from Sarthe, a large portion of the arondissements of the Momers and of St. Calais; from Loire and Cher, finally an important fraction of the arondissement of Vendome. Perche is therefore in Normandy, Beance, Maine, and Vendome. This area forms an ellipse of one hundred kilometers in length, and about eighty in breadth, bounded on the north by Normandy, on the west by Normandy and Maine, on the east by the Chartrain country and that other portion of Beance called the Dunois, and on the south by Orleans proper. After stating that the Percheron horse is of recent origin or formation, Mr. Klippart says:

It is, in every sense of the word, an artificial or fictitious product, and is not a type, as has so frequently been asserted by writers and repeated by others. It is no longer a pure race, as has often been stated, because it has neither antiquity nor homogeneity. During the past fifty years it has received many very important modifications, due to the mixtures or crosses with very different varieties; and there are great changes being produced on it at this moment. The most complete, and at the same time the most precise, definition which has been given it is this one: *The percheron is a gray horse.* In fact, everywhere in Perche every gray horse is called a Percheron. Every year, thousands of fillies are brought there from Bretagne, a very great number, undoubtedly, the offspring of Boulonnais; from Flanders and from Picardy, where three very distinct varieties of heavy and powerful draught horses are bred and reared. Then there are the offspring of mares in the country, the progeny, as already stated, of very diverse stallions. From such a diversity and disparity of elements no *pure* race can be produced which shall be homogeneous in appearance and transmit its qualities with certainty to its offspring. In a word, these cross or diverse bred horses have the power or faculty of constancy in reproduction in so very slight a degree, that nowhere do we find the form and exterior characters corresponding with the reputed aptitudes and specific qualities any more than if an attempt had been made to produce them anywhere or everywhere in any part of France or elsewhere, with any strain or race of horses.

Mr. Klippart then gives the following description of the Perche horse:

The small or light Percheron, such as is employed in the post-chaise or diligence, is a horse of from 14 hands 3½ inches to 15 hands 3 inches high, and is a little high in the thighs. Viewed in front, the head is sufficiently square and well turned. When examined in profile, it appears rather long, narrow, and flat. The eye is small, inserted under a large arch. The ear is small, tapering, and almost always has the appearance of carelessness in its position. The neck is short, straight, slender. The protuberance of the withers generally sufficiently developed to be perceptible. The shoulder, notwithstanding its strength, is straight and short, yet is rather flat. At birth the forearm is weak. The loin is large and well supported, indicating great power. The croup is heavy—sometimes a shade higher than the withers; at other times it falls below the withers, and in such case the tail seems to be badly set. The buttocks are muscular, but do not descend sufficiently low down. The thigh, on the contrary, is rather long and slender. The limbs are bony, but rather short-jointed. The hoof is always good. The body is ordinarily well made, and of as round a form as those of the choicest races. Nevertheless, the chest does not present a desirable amplitude; it does not present the full dimensions which render the Norfolk trotters so powerful, and which, by the way, very strongly resemble the Percheron both in structure and aptitude.

RHODE ISLAND.

The transactions of the Rhode Island Society for the Encouragement of Domestic Industry for the year 1873 are contained in a pamphlet of about two hundred pages. The work contains the list of premiums offered and awarded at the annual exhibition of the association for the above year, the names of the officers of the society from its organization

up to the present time, and necrological notices of many members who died during the year. The secretary gives the names of the decedents in the order of their decease as follows: Thomas F. Hoppin, Henry D. Browne, Stephen Crary, Thomas E. Steeve, Benjamin F. Hopkins, William E. Richmond, Richard James Arnold, James T. Rhodes, Edward S. Wilkinson, William H. Gardiner, Dennis Sawyer, Joseph Spink, Moses Smith, Warren Cook, Jeremiah G. Chadsey, Elisha W. Baker, Joseph Mauran, John J. Kilton, Samuel B. Cushing, Suchet Mauran, Edmund Bagley, William E. Hamlin, Henry J. Angell, Owen Mason, Almoran Harris, Thomas R. Allin, Palmer Dorrance, and William S. Patten. The society still numbers about thirteen hundred members.

The annual exhibition of the association for this year was held at Narragansett Park, and was very successful in every respect. The receipts of the fair amounted to $10,448, and the expenditures to $10,129.54, leaving a balance in hands of the treasurer of $318.46. The exhibition of stock was larger, and the quality much superior to that shown at previous fairs. Other departments of the exhibition showed an increased interest on the part of exhibitors, and the opinion seemed general that these fairs should become more certain and permanent in their character.

The secretary, in his general report to the society, makes the following allusion to the non-appearance of the annual report of this Department for the year 1872:

> Great disappointment is manifested by many of the members of the society and others in not being able to obtain copies of the report of the Department of Agriculture for 1872. The abolition of the franking privilege led to the neglect, on the part of Congress, to provide for the publication of the usual number of these valuable reports, and the application to purchase copies from the Congressional Printer elicited the response that the edition was exhausted, and that none could be obtained until Congress had ordered the printing of a new edition. The committee recommend that the society, at the annual meeting, pass a resolution requesting the senators and representatives in Congress from this State to use their influence to procure the printing and distributing of a liberal edition of this valuable document.

Prefacing the report of Mr. J. H. Barden, one of the fish commissioners of the State, is a brief history of the progress of fish culture in Rhode Island. In examining the records of the society, the secretary finds that as early as December, 1825, efforts were being made to encourage the breeding of fish in fresh-water ponds. About this time the standing committee of the society offered premiums for the most successful efforts in breeding and fattening fish in fresh-water ponds. From that date up to the present time the society seems to have exerted its influence to encourage the breeding of fish in the waters of Rhode Island.

The following facts in regard to the operations of the commissioners during the year are gleaned from Mr. Barden's report: Black bass have been caught in some of the ponds previously stocked by the commissioners. Some of the ponds have been visited by the commissioners, and they are satisfied that their efforts with this variety of fish have been very successful. During the year they have stocked ponds in Coventry, West Greenwich, Exeter, Hopkinton, North Kingstown, South Kingstown, New Shoreham, and the Easton pond in Newport and Middletown. Of 100,000 salmon ova received from Maine, 66,000 were hatched, and when about eight weeks old 12,500 were placed in the Slatersville branch of Blackstone River, 16,000 in the North branch of the Pawtuxet, and 10,000 in the South branch of that river. Twenty-seven thousand five hundred were placed in the Pawcatuck and Wood Rivers, at several different points, with a loss of not over three thousand in all. The agent of the commissioners has made arrangements

for securing two and one-quarter millions of salmon ova for distribution. A supply of young shad-fry was received from the commissioners of Massachusetts and Connecticut, and were all placed in the Blackstone, Pawtuxet, and Pawcatuck Rivers without the loss of a single fish. Thirty thousand trout ova were received from Mr. Seth Greene's establishment in Western New York. Of these the commissioners were successful in hatching only six thousand. They were placed in ponds prepared for them, but by the rising of the water, caused by a heavy shower, the screens became filled and the young fry were washed out into the river. A fine lot of young fry, of last year's hatching, were lost by the drying up of springs which fed the ponds in which they were confined. To remedy this, and guarantee a full supply of water in the future, the commissioners have turned a stream of unfailing water so that a portion of it will run through their ponds at all times.

WISCONSIN—HORTICULTURAL.

The volume containing the transactions of the Wisconsin State Horticultural Society for the year 1874, is comprised in about two hundred closely-printed pages. The public work of the society for the year consists of the proceedings of the regular annual meeting held at Madison on the 3d, 4th, and 5th days of February, 1874, with its addresses and discussions, and an account of the annual exhibition at Milwaukee, in connection with the exhibition of the State Agricultural Society; a meeting for discussion at that time; and a small show of fruit at the American Pomological Society meeting at Boston, in September, 1873. Notwithstanding many unfavorable circumstances, the exhibition of horticultural products at Milwaukee was exceedingly creditable to the fruit-growers of the State. In quantity there was some falling off in comparison with former years, and possibly in the general average excellence, and yet there were exceedingly fine specimens shown in every class.

In his opening address before the society at its meeting at Madison, President Stickney alludes to the severity of the past year, and says it has resulted in the destruction of all the fine theories of the fruit-growers of the State. The fruit-lists were fearfully cut down, and in the future the plans of the horticulturist must widely differ from those of the past; but into future plans should come no thought of planting a vine or a tree less, or of being deprived of one luxury that the orchard or garden can produce. He then asks:

Wherein does the lesson of last winter differ from that of 1856? Then we had been for years planting anything and everything that the eastern nurserymen sent us; and the weeding out of everything unfit for this climate was thorough and complete. As far as we have again planted those tender kinds, this lesson is an exact repetition of the old; and but for the presence of the extra hardy kinds, this would have been just as severe. We see the results of that former lesson in our improved Siberians, and our Tetofski, Duchess, Walbridge, Pewaukee, Haas, and others, which then were scarcely known, or at least not appreciated.

Had our memories served us better, and our faith in a few delusively mild winters been less, last winter's severity would have been harmless. It is true that many of our iron-clads and even Siberians were killed, but the injury was at the roots, while the tops were unharmed, and the causes of this root-killing being largely within our control, it can and must be prevented. Knowing that these severe winters must frequently come, and that the planting of anything less than iron-clads will only bring loss and disappointment, let us search earnestly for every good and hardy kind. Let us put forth new energy in the production of new varieties from seed. Let us, in our discussions, consider all the causes of our root-killing, and devise ways and means to prevent it.

Mr. L. Woodward gives some directions for planting and cultivating apple-orchards. He prefers a northern or eastern slope, with gravelly loam or limestone soil. The ground should be plowed some 10 or 12

inches deep; timothy-ground, well broken and subsoiled, is the best. Trees should be set 20 or 25 feet each way. If planted on timothy-sod, the holes should be dug about 20 inches deep and a layer of the sod placed in the bottom. The holes should be large enough to take in all the roots of the young trees, and they should be set about two inches deeper than they grew in the nursery. After cutting off smoothly the mutilated roots, use the hand in working in the fine earth around them. Fill up and press down with the foot, and mulch with coarse manure. While the orchard is young plow the furrows toward the trees, until a ridge of six inches or one foot high is raised, which will prevent the roots from freezing during severe weather. Plant the orchard to some hoed crop, and cultivate from early spring to the middle of July only, as cultivation after that time produces too late a growth, leaving the tree in an unripe condition at the setting in of winter.

Mr. E. H. Benton contributes an article on the same subject, in the course of which he says:

Never sow any small grains in an orchard unless you are sure none will grow within a circle of six or eight feet about each tree. Better raise beans, potatoes, or corn, until the trees come into bearing, but never fail to throw sufficient earth around each tree to make a mound a foot high and three feet broad, the last of November, to be removed when the buds begin to burst in spring. An orchard can be raised in grass-land, (clover is least likely to do any material damage,) if the whole surface is well manured each year, but it is recommended to break it up and raise some hoed crop as often as once in three or four years. The natural effects of seeding down an orchard is to check growth and induce fruitfulness, but the fruit is not as likely to be so large or as good flavored. The danger incident to cultivating an orchard is, to produce too much and too late growth, thereby rendering the trees liable to fire-blight and winter-killing, both of tops and roots.

No amount of foresight or precaution can entirely overcome the climatic difficulties incident to fruit-growing in large areas of our Western States. Certain localities contiguous to bodies of water and timber will scarcely feel these untoward influences, but to most of us it will be more or less a precarious business even with the hardiest varieties known. The writer had healthy, vigorous trees, in a good location, of the hardiest varieties. killed indiscriminately in the winter of 1872-'73. and root-killed at that, and from extensive observation the past summer he is certain that had his trees been protected by mulching or a mound of earth, they would have all lived. Trees of the same variety, age, and only 16 feet from them, in clover-sod, were not killed.

In the course of an able paper on the subject of grape-culture, Mr. N. F. Lund gives the following directions for the proper pruning of vines:

If asked to state, from my own experience, what I consider of the most importance in grape-culture I should unhesitatingly reply, stopping and controlling the growth within proper limits. This opens the whole subject of pruning, more especially what is so often erroneously termed summer pruning. * * * Properly, summer pruning is the removal of large quantities of superabundant leaves and shoots which have been allowed to grow unchecked until the wood is nearly ripened. Many practice this under the pretense of "letting in the sun and air to the grapes." While grapes will not ripen well, nor vines be healthy under a dense mass of matted foliage, this is not an evil to be remedied by the knife. Summer pruners should observe that all the finer bunches grow and ripen under the shade of the leaves. The sun direct upon the wood or fruit is not necessary to their perfect ripening; yet the vine, as a whole, should have the full and free benefit of sun and air; then, if proper training has been given, observation will show the leaves adapting themselves in such a manner as to shield both wood and fruit from the direct rays of the sun. * * * The process of checking growth should commence the first season of planting by pinching laterals on the first shoot, and should be continued each year on every shoot grown. Only a single shoot should be allowed to grow on each plant until the stock is of sufficient size for the bearing-canes to be grown. Laterals should be stopped at the first leaf, and as they start again, repeat the process. The entire removal of the lateral, as practiced by some, I consider very objectionable; springing as it does from the axil of the leaf and shoot, its removal leaves a wound where there should be none, as, close beside it, the dormant bud is perfecting, and nothing should be done that will disturb its perfect formation; then, again, the dormant bud may push if the growth be rank: this is not liable to occur where the lateral is pinched to one leaf.

During the first year, and until the vine is in bearing, it is better, for many reasons

to allow the main shoot to grow, without checking, until late in August, when it should be stopped; this insures the full development of the roots; the perfect ripening of shoot and buds, and the leaves will drop from ripeness without waiting for frost. When the vine is in bearing the shoots should be stopped at from two to four leaves beyond the last cluster, according to the vigor of the vine; some varieties requiring greater length of shoots than others, owing to their rampant growth.

Of the importance of removing tendrils, he says:

Three years since, in trying to remove a large tendril which had reached out and was clasping a neighboring shoot and its cluster, I naturally found I could not break it. Applying the knife and carefully untwining it, the shoot and cluster were saved from being strangled. The question at once arose, why pinch the laterals to prevent superfluous growth, and allow this waste of nutrition in the growth of this tough, wire-like tendril, which is entirely useless? Acting at once upon the thought, I removed the tendrils from my vines, and have since continued to do so, to the evident benefit of fruit and vine.

Mr. C. H. Greenman, in the course of an article on the subject of injury to trees and vines in 1872–'73, attributes the great destruction of apple-trees to extreme drought followed by intensely and long protracted cold weather. He says that the rain-fall during the months of October and November, 1872, was far below the average, while early freezing in December prevented the absorption of moisture by the soil. The continued hard freezing, together with the dry thaws of early spring, evaporated a large portion of the moisture contained in the soil, leaving the ground comparatively dry, and this was especially true on gravelly and sandy soils, which produced nearly the same effect as that of freezing in the open air. Trees and vines were injured very little, if any, on clay lands, and their escape is due to the retentive nature of the soil, which prevented the roots from freezing dry. Exceptions were found in either case, and was attributable to hardy roots in the former, and tender ones in the latter. In a block of Duchess of Oldenburg trees, a portion were killed or materially injured, while others in the same row were not hurt by the winter. An investigation showed that the sound trees were on their own roots, while the damaged ones were on the seedlings, and had not rooted from the scion. Crab-apples, with very few exceptions, escaped the injury, no doubt from the reason that they were on hardy roots. Hence he attributes the injury mainly to dry freezing and tender roots.

Mr. Greenman says that his experience has demonstrated that there is a great difference in the construction of roots, varying in different species. Some are composed mostly of alburnum, covered with thin bark, while others are mostly bark, with a small amount of alburnum or woody fiber. These vines were injured in their roots in proportion to the amount of alburnum contained in their construction. Those with thick bark are the most easily injured by freezing, as well as those which are first affected by mildew and blight. The alburnum will remain sound when the outside bark is entirely destroyed by the winter. European varieties and their hybrids have large fleshy roots, while the Lubrassa is not as much so, and the Cardifolia least so of all. Should his theory prove true, it would seem that a partial remedy against the recurrence of similar losses in the future may be found in producing trees on known hardy roots, which, with most varieties, can be accomplished by grafting long scions on short roots, planting deep enough to induce rooting from the scions, and liberal mulching, which will prevent the evaporation of moisture during the winter.

At a meeting of the society held at Madison in the month of February, the theory advanced by Mr. Greenman was discussed at some length. Mr. Wilcox said that he had in his orchard some seventy different varieties of apple-trees, from four to fifteen years old. The Duchess of

Oldenburg, Red Astrachan, Plumb's Cider, and many of the crabs were either winter-killed or bandly injured. He had been advised to use stalks from crab-apple seeds, and hereafter it was his intention to use none but the hardiest varieties.

Mr. Barney alluded to the fact of trees dying from root-killing, while others, where roots had started from the scions, were uninjured. Mr. Finlayson thought a distinction should be made between young and old trees. On higher, heavier soil, nursery stock stood pretty well. Much of the injury seemed to be done by the late frosts of the spring of 1873. Many of the older trees stood pretty well. Mr. Wilcox gave an instance of an orchard in his neighborhood, on heavy soil, on a ridge. On the top and west side the trees were mostly killed; on the east side they stood better. In Trempealeau County the young trees generally fared better than the older ones. Mr. Willey gave instances showing that trees supposed to be on crab-roots were killed. Vice-President Tuttle said that trees will kill more readily on sandy or gravelly soil than on loamy or clay soil. On the first soil the frost goes deeper. Trees should be set deeper in the orchard than they stood in the nursery. Mr. Harris stated that last winter he found the soil frozen to the depth of 5 feet 6 inches.

The following is the revised list of fruits recommended for general cultivation at the February meeting of the society:

Apples.—Tetofski, Duchess of Oldenburg, Haas, Plumb's Cider and Fameuse—five varieties, hardiness only test; and for general cultivation and experiment, Walbridge, Red Astrachan, Utter, Westfield, Seek-no-further, Ben Davis, Talman Sweet, Saint Lawrence, Willow Twig, Pewaukee.

Grapes.—Delaware, Concord, Lindley, Wilder, Salem, Agawam, Janesville, Worden, Eumelan. For trial, Isabella.

Raspberries.—Philadelphia, Davison's, Thornless, Doolittle, Miami; add Fastolff, and Brinckle's Orange, if protected in winter.

Strawberries.—Wilson's Albany, Green Prolific. For trial, Peak's Emperor, Charles Downing, Reed's Late Pine, Victory, Burns's New Pine, Boyden's No. 30, Arena.

Pears.—For trial, Flemish Beauty, Ananas d'Ete, Early Bergamot, Bartlett, Swan's Orange, Seckel, Winter Nelis.

Plums.—For trial, Lombard, Imperial, Egg, Magnum Bonum, Hinkley, (or Miner,) Yellow Egg, Eldridge.

CALIFORNIA.

The report of the transactions of the California State Agricultural Society for the year 1873 is one of unusual interest, and contains matter of much value to the farmers of the Pacific coast. The report is well printed, and contains over seven hundred pages.

The volume opens with the annual report of the directors of the society, who give a brief account of the farm operations of the year. They state that from July 1, 1873, to December 31 of the same year, the receipts of wheat at the various points of export amounted to eight million six hundred and thirty-seven thousand one hundred and six centals, and, much to the surprise of all interested in the product of this year, the crop turned out to be as great as that of the preceding year, viz., thirty million bushels, or nine hundred thousand tons. Wool is given as the next in value as an article of export. Each year shows an increased attention to the rearing of sheep, and a consequent increase in the production of wool. The current year shows the clip of the State to be one-sixth of all the wool produced in the United States. The largest yield ever claimed in any preceding year was one hundred and eighty million pounds. The last clip is given at thirty-two million pounds, valued at six million dollars. The yield was about six pounds to the fleece, but the directors think by culture and improvement in crossing

it can be made to yield ten pounds to the fleece, thereby doubling both in quantity and value.

The progress of cotton-culture in the State is dwelt upon at some length. That the soil and climate of many localities are susceptible of producing abundant crops of an excellent quality of cotton has already been abundantly demonstrated by the successful experiments made by Mr. Strong, the Buckley Brothers, and others, of Merced County. Their efforts have resulted in the production of cotton as good as can be grown in Mississippi or Alabama, and the yield per acre has been fully as large as in any of the Gulf States. Efforts have also met with measurable success in Fresno and San Joaquin Counties, and preparations are making for extensive experiments among the farmers in Amador Valley, Alameda County. The soil of this valley is of the same character as that in the Merced cotton-fields, and the climate is regarded as equally favorable.

The reduction of beet-sugar has proved entirely successful at the manufactories at Sacramento and in Alameda County. About one million dollars is invested in the enterprise. The yield of beets was about twenty thousand tons, from which about three million pounds of saccharine matter was created. The directors think this yield will be greatly increased during the coming year.

The secretary calls the attention of road-supervisors to the act passed in 1868, providing for the planting of shade and timber trees along the public highways of the State, and recommends the following varieties as hardy, of rapid growth, and many of them valuable for either wood or timber: Black and honey locust; black, white, and fruiting mulberry; Osage orange; native and eastern black walnut; American chestnut; European, American, and cork-bark elm; the different kinds of maple; the tulip-tree; Carolina, Lombardy, and silver-leaf poplar; different kinds of ash; the apple, pear, plum, cherry, almond, and fig; eucalyptus, or Australian blue and red gum, Monterey pine; sugar-pine; yellow pine; spruce pine; Norway spruce; balsam fir; Scotch pine; European larch; Monterey cypress; Italian cypress; California redwood, and California laurel.

The list of premiums offered and awarded at the late State fair is given. The annual exhibition of the society for this year seems to have been successful in every respect. The receipts for the year amounted to $51,462.04. The expenditures equaled this amount, the larger portion being used in payment of premiums on articles exhibited at the fair. Hon. A. A. Sargent delivered the opening address at this fair. In the course of his remarks he speaks of the importance of cotton-culture, and says that "during this year three hundred thousand pounds of cotton have been raised in California. The article is nearly as good as sea-island cotton, is very strong, and is just what is needed to mix with wool for the fabrics produced at our woolen-mills. One mill alone uses four hundred thousand pounds, and all the mills together use three times as much as is raised in this State." The greater portion of Mr. Sargent's address was devoted to a discussion of the subject of transportation.

The annual report of the surveyor-general of the State is contained in this volume of the transactions of the society. He gives the area of the State as follows:

Commencing at about thirty-two degrees thirty minutes north latitude, the State of California extends north to the forty-second parallel, having an average width of about four degrees, and covers an area of about one hundred and eighty thousand square miles, or about one hundred and twenty million acres. There are about five thousand Government townships in the State, (whole and fractional;) of these, two thousand two hundred and eighty-four have been surveyed by the United States, the remainder being unsurveyed.

Of the capabilities of the soil and climate of the State, the surveyor-general speaks as follows:

The resources of the State of California are, perhaps, more varied than those of any other of the States of the Union. Its very large area, its geographical position, and the high elevation of its mountain-ranges, bestow upon it climatic advantages of the highest order. In the extreme northern portion of the State the temperature is never so low as to necessitate the precautions and inconveniences to which the Middle States of the eastern slope are subjected; neither is the most southern portion of so high a temperature as to propagate either the malaria of a tropical country or the lassitude and indolence of its inhabitants. Ever swept through her whole length and breadth by moderate winds, fresh from the bosom of the Pacific Ocean, the extremes of heat and cold are unknown to California.

The soil of California is as prolific in its character as it is varied in its adaptations, producing with equal facility the vines of continental Europe, the hardier cereals of northern America, and the luxuriant fruits and flowers incident to the tropics. Her mountain-hills and streams are the depositories of gold, silver, and valuable minerals, in quantities that have attracted the attention of the civilized world. Her inhabitants are the representatives of every nation on the face of the globe—an enterprising, active people, that have, in a few years, erected a prosperous State upon the most remote borders of civilization.

With these natural advantages of soil, climate, and mineral deposit, no uncertainty as to the future of California can reasonably be entertained. Her population is steadily increasing; her resources are each year being more completely developed; her immense area offers every inducement to immigration, and, judged by the American standard of progress, she is destined not only to maintain her past proud position among her sister States, but to attain a pre-eminence that shall be as enviable as it is deserved.

Of the varied productions of the State, he says:

The fruit-products of this State are, perhaps, of greater variety than those exhibited by any other branch of agriculture, and, in their variety, are more characteristic of the peculiarties of California climate and soil than any of the many evidences that have yet attracted public attention. All the fruits of the temperate zone are produced in profusion, and attain an unusual size and flavor. In the more southern counties many fruits incident to tropical climates are produced with profit and in abundance. Oranges, lemons, figs, pomegranates, limes, and olives are yearly figuring more extensively among California productions. The fruits of this State are demanded by the epicures of the East, and are shipped in large quantities to all parts of the Union.

The mountains of the Coast Range and of the Sierra Nevadas are covered with almost virgin forests, embracing valuable timber of endless variety, the Coast Range producing an unlimited amount of the redwood timber peculiar to that locality, and so truly valuable for its self-preserving qualities, as well as the laurel now so extensively used for various ornamental purposes. The large growth of redwood timber, as well as laurel, is principally confined to the counties of Humboldt, Mendocino, San Mateo, and Santa Cruz. Millions upon millions of feet of redwood lumber are each year cut in these counties for the supply of home demand, and for shipment to South American and Mexican ports, as well as to the islands of the Pacific Ocean. The pine, spruce, and fir of the Sierra Nevada Range supply the large demand for home consumption, as well as for the large extent of untimbered territory lying along our eastern boundary.

Cattle and sheep raising have become thoroughly identified with the interests of California. The even temperature of climate at once does away with the most serious obstacles incident to this branch of industry in the Northern and Middle States. The winters are of such a nature that neither cattle nor sheep require protection from the inclemency of the weather; good feed is found during all the months of the year; even in the driest periods of our long summers, the grass, that to all appearances is withered and unfit for consumption, contains all the nutritious qualities of well-cured hay, while upon the first rains of winter the pasture is at once covered with grass to supply the needs of the succeeding year. Much attention has of late been paid to the improvement of the breeds of cattle, and whereas but a few years since the country was filled with cattle of inferior size and quality driven here in times of high prices from the plains of Texas and Mexico, it has now become the home of the descendants of the most valued domestic and imported breeds. The same follows with sheep and goats. The wool-clip is annually becoming larger and of a better quality. Sheep in California are sheared twice during the year, and the product at all times commands remunerative prices. Range for these animals is plenty, and sheep and wool growing in California has given it no small share of its celebrity. This may principally be attributed to the same climatic causes that offer such inducements in the raising of cattle. By sheep-raisers here it is calculated that the flock will more than double itself in number each year, and that the returns from sales of wool will be in excess of all expenses incurred, thus leaving an annual profit of the total increase in number, amounting virtually to over one hundred per cent. upon the amount invested in the purchase of the flock. The principal cattle-raising counties of the State are Monterey, San

Luis Obispo, Siskiyou, Santa Clara, Sonoma, Kern, Fresno, and Humboldt, and the chief sheep-raising counties are Los Angeles, Santa Barbara, San Luis Obispo, Fresno, and Merced, the county of Marin far exceeding all other localities in the products of the dairy.

Wine-making, as a general industry, is steadily pushing forward its claims to attention. Each year proves the climate and soil of California to be better adapted to the culture of the grape. Vines grow upon the hills, and in the valleys, bearing an abundance of fruit of every conceivable variety. The principal wine-producing counties are Los Angeles, Sonoma, Napa, Sacramento, and El Dorado.

Humboldt County, in the year 1872, produced twenty-one thousand four hundred and eighty tons of potatoes. San Mateo and Sonoma Counties came next. San Mateo raised during this year eight thousand two hundred and forty-two tons, and Sonoma seven thousand eight hundred and forty tons."

The report contains a very interesting article taken from a recent local publication, giving a detailed account of the *Eucalyptus* forest, planted and owned by Mr. James T. Stratton, of Alameda County, California. Mr. Stratton had his attention first attracted in the direction of forest-culture, by observing the rapid growth of the *Eucalyptus* or blue-gum trees growing on his place at Oakland. This was in 1869, and in April of that year he secured all the seed he could from these trees and immediately planted them in a nursery. From these seeds he succeeded in raising about forty thousand young trees; about thirty thousand of which he planted in November and December of that year, in a permanent plantation, eight feet apart each way, covering in all about fifty-four acres. These were of the variety *Eucalyptus globulus*, or blue-gum of Tasmania, and three years after planting were generally from thirty-five to forty feet high, and from five to nine inches in diameter two feet from the ground. In the spring of 1872 he planted about fifty thousand more young trees, covering about sixty acres of ground, and choosing for this planting a high hill, the soil of which was quite sandy, and classed by farmers in the neighborhood as about the poorest soil in the vicinity. A certain and complete failure was predicted with these trees; but the result has shown that Mr. Stratton acted wisely, as the trees are making almost as rapid growth as those of the first planting, which are nourished on rich valley-land. At the age of about two years these trees were from twelve to twenty-five feet high, and from two to four inches in diameter. Since the first planting, Mr. Stratton has added about twenty thousand more trees of various varieties to his hill plantation, blue-gum, red-gum, iron-bark, stringy-bark, &c., all of which are doing well, and look as healthy and vigorous as if they were growing on their native Australian hills. Again, in the spring of 1873, about thirty thousand more trees of different varieties of *Eucalyptus* were added to the two plantations, making in all about one hundred and thirty-five thousand trees, and covering an area of about one hundred and seventy acres.

Mr. Stratton commenced this enterprise for the purpose of growing wood for fuel alone, not dreaming that a tree of such rapid growth as the *Eucalyptus* would prove valuable as a timber-tree; but experiments recently made demonstrate that it will successfully compete with any of the imported hard woods, hickory alone excepted. An inch-square stick of blue-gum, taken from the sap, suspended horizontally on supports two feet and six inches apart, sustained on a center point two hundred and sixty pounds without breaking, being bent by that weight only one inch, showing a strength equal to the average of imported ash. Its specific gravity is six hundred and eighty, that of eastern ash and maple being about seven hundred and fifty. It is not, however, regarded as durable under ground, as a plank three feet long, two inches thick and fifteen inches wide, including the sap as well as the heart of a tree ten years old, planted two feet deep, completely decayed in one

year beneath the surface, while the part above ground remained perfectly sound.

Since the starting of this forest the medicinal value of the *Eucalyptus* has been confirmed, and the hospital experiments made by Dr. J. S. Coleman, of San Francisco, indicate that the extract of its medicinal properties is doubtless destined to become a valuable substitute for quinine as an anti-periodic tonic and febrifuge, and that it is an invaluable remedy in diseases of the kidneys, bladder, &c. So abundant is the active medicinal principle in the leaves of this tree, as determined by Dr. Coleman's experiments, that should quinine be entirely supplanted by the new remedy, Mr. Stratton estimates that his *Eucalyptus* forest alone would supply the demand for the whole United States.

Dr. S. Kellogg gives the following method of planting and cultivating Venetian sumac, (*Rhus cotinus* :)

The best plan is to start the seeds in beds. The proper season for transplanting in this climate is November, December, and January. Of course the best time is the commencement of the rainy season. Plant two to four feet apart in the rows, and rows four to six feet apart, for space best suited to plow and harrow or horse-hoe, say two or three cleanings. In Sicily the rainy season closes in May, like ours, when the crop is laid by, previously hoed, as stated. The crop is gathered in July or August, cut four to six inches from the ground, and laid in handfuls—not spread out for a day or so to dry—not allowed to bleach. The leaves of young sprouts, that spring up vigorously every year, are the only parts used, as they are free from dead or decaying leaves of the older trees. Care on this point, and a dry climate like ours, where no casualty of rain ruins an occasional crop, has given Sicily a staple reputation in the markets of the world. There are, nevertheless, those who adulterate the article. The whole twigs, leaves and all, are cut up and used for tanning. Since the cultivation of the plant in Maryland and Virginia the price of the foreign article has fallen, as it proves inferior, except for its lighter and clear hue, the American being a little greenish yellow. Yet the latter has risen twenty to forty per cent., while the Sicilian article has correspondingly fallen.

The writer states that this plant can also be propagated from cuttings, roots, stems, or by layers.

Dr. J. Strentzel gives a brief account of a disease which has recently made its appearance in the peach-orchards along the Sacramento River. It was first observed two years ago, and appears to be a new fungus or lichen, which covers the fruit in ash-colored blotches, and the ends of growing shoots in detached masses, spreading out from a cottony tuft of a growing germ. The leaves on the affected part drop off later in the season, and the end of the shoot generally dries up. The growth of the fruit is not apparently checked, but the thin-skinned varieties, on ripening, get a puckered-up, pocky, disgusting appearance. The earlier varieties are most affected; the yellow, among them the Crawford, not so much. None has been noticed on the Snow peach. The writer says that the present year (1873) the disease has appeared in an extended circle, and is causing still greater injury to the fruit. Dr. Strentzel says:

It is not pretended to assign a cause for this anomalous growth, beyond that the peculiar atmospheric condition was favorable to its rapid development. The trees may have been also depleted of vitality, or this having been an unpropitious year for the "curled peach-leaf," the superabundant sap found a new parasitic consumer. But it can be reasonably hoped that some of the usual means employed for the destruction of kindred growths will be serviceable in this case. That the disease will certainly spread to all parts of California can be fully apprehended. The losses thus incurred would be severe to horticulturists. Thus it is of importance that every experience should be brought to public knowledge, and every means of extermination at once tried. The burning of the pruned offshoots should be rigidly followed; the ground around the trees scraped and limed, and the whole orchard repeatedly fumigated, early in spring, in favorable weather, by keeping up numerous smoldering fires of spent tan-bark, or damp straw mixed with asphaltum or coal-tar. These are the most available means for the destruction not only of varieties of mildew, but also of innumerable noxious insects.

Several county and district societies make interesting reports, but a lack of space prevents any allusion to them. The transactions of the

California Vine Growers' and Wine and Brandy Manufacturers' Association is regarded as of sufficient importance to demand special attention, and therefore considerable space is given to quotations from the annual address of G. G. Blanchard, president of the association. Speaking of the production of the State for the year 1873, Mr. Blanchard says:

There will be produced this year from twelve to fifteen millions of gallons of wine, of the value of three million five hundred thousand dollars, besides about two millions of pounds of grapes for table use, worth about two hundred and fifty thousand dollars, and one-quarter of a million pounds of raisins.

There is not within this State to exceed forty thousand acres planted to vines. Of hill and mountain land alone, which is eminently susceptible to the cultivation of vines, there are more than eight millions of acres. With reasonable cultivation, and without diminishing any of the other productions of the State, we have acres sufficient to produce annually from the vine more than two hundred million dollars; and these lands are mostly unsuitable for any other production as a staple. Our highest prosperity will never be reached until the occupation of these lands is made an element of legislation—until the subject shall receive encouragement and aid. Commerce is not to be forgotten; manufactures should not be overlooked; nor our mining interests neglected; neither should this greatest and most natural resource of the State—vine-growing—be made the subject of legislative oppression. * * * * * Grape-growing and wine-making are steadily advancing on a permanent basis. The frost of the month of April last not only proved disastrous to California, but also to nearly all the vineyards in Europe: and from accounts from there not more than a third of a crop is expected to be harvested.

The phylloxera, which has made its appearance in Europe, has also been discovered in California. This may be owing to atmospheric influences, probably, as some think, from the large amount of magnetism which has been thrown out through the solar system by the sun for the past two years; and this may have something to do with generating a particular class of insects. It is the opinion of gentlemen who have been engaged in the grape-growing business for fourteen years or more, that the phylloxera have been among the vines all that time, and as yet have done no serious injury. Those vineyards that seem to suffer the most have been neglected or have been badly attended to.

CONNECTICUT.

The seventh annual report of the Connecticut State Board of Agriculture for the year 1874 is contained in a volume of over four hundred pages. The greater portion of the work is devoted to a discussion of the merits of different kinds of fertilizers, and the proper time to apply them.

The usual winter meeting of the board was held at Meriden, December 17, 18, and 19, 1873. The meeting was a public one, and its principal object was the discussion of such subjects as might be brought before it relating to the agricultural and productive interests of the State. The meeting was opened by the reading of an essay by Mr. T. S. Gold, secretary of the board, on the subject of the "sterility of soil, its causes and remedies." In his opening remarks the writer stated that a good soil contains in itself not only sufficient plant-food to produce good crops at present, but material laid up in store, which, by the slow action of the elements, and vegetable growth, is gradually decomposed, so as to allow of the removal of a certain amount of vegetation from year to year; and yet there are few soils where this depleting process can be continued for a term of years and they continue anything like their original productiveness. It should, then, be the principal aim of the farmer to so aid and control these natural processes that his fields from year to year may become more productive—that two blades of grass may be made to grow where but one grows now.

Mr. Gold considers the proper conditions of soil of paramount importance in all successful farming. Where too much water exists, a system of thorough drainage should be instituted, and where there is a lack of moisture, irrigation is the only sure remedy. Standing water is injuri-

ous to plant-life. It prevents the entrance of air into the soil, hinders decomposition, and favors the formation of compounds inimical to vegetable growth. Only coarse and useless plants will grow and thrive in stagnant water, or on soils where water stands at a depth of two or three inches below the surface. These wet, sour soils are composed largely of clay, with a subsoil of like character. On gravelly soils, where vegetation starts with great promise in the spring, but is soon dwarfed and parched by summer heat and drought, irrigation forms the surest and speediest remedy. The mechanical condition of such soils can be much improved by the admixture of clay and loam, thus rendering them more retentive of moisture, and better able to withstand a drought. He says that extensive irrigation somewhat diminishes the necessity for it. Where a large surface of water is exposed to evaporation, the air becomes less dry and parching as its capacity for moisture is in part supplied, and the rain-fall is increased. Rain falling from a cloud through the parching air of a desert will be dried up, absorbed, before it reaches the earth; but if the air is saturated, or nearly so, it will not be diminished in its descent, but may continually increase.

Mr. Gold thinks that too much plowing has reduced some land to sterility. By continuous exposure to the air, all its vegetable matter may become decomposed, its plant-food consumed or wasted, and its already too porous state increased. Laying down to pasture for a period of years, with tramping the surface by young stock, or, what is still better, sheep-pasturage, is regarded as the best cure for land that has been thus overworked. If manure can be spared for such land, it will give a quick return, but pasturing with sheep, especially if they are daily fed with bran or grain, will be found the best means of restoring these sterile lands to fertility.

Another prolific source of the exhaustion of soils is the repeated planting of the same crop for a series of years. Either the elements needed for that crop are exhausted, or the land is brought into such a mechanical condition as to be unfavorable for its growth, or some fungus disease is developed, as in the case of smut in onions, so that practically that land has become barren and unproductive for that particular crop. This has given rise to the practice of a rotation of crops, which is a wise step toward successful farming.

Lands may contain all the elements necessary for the growth of plants, except perhaps one or two, and still be barren. Lacking these, useful plants will not grow at all, or fail to perfect their seeds, which are the most important part in grain-bearing species. Land is sterile when it lacks clay or vegetable matter to hold water and ammonia; it is sterile when the clay predominates too largely—it is too compact; it is sterile when it is pure vegetable matter, as clear muck. In the first case an application of clay or muck, or the plowing in of a green crop, is indicated; in the second, a dressing of sand, and in the last the application of sand or loam. These substances, thus applied, are called amendments, and often produce wonderful results, and land which could hardly be rendered productive by any amount of manuring, develops a fair degree of fertility.

The reading of this essay was followed by an animated discussion, which was participated in by many of those present. In reply to a question as to the beneficial effects of plowing in green crops on clay soil as compared with sandy loam, Dr. Riggs said:

I have not had much experience in plowing in green crops upon lands; that is, on what I call hard clay lands. The land that I have practiced it most upon is a light, sandy loam, but it is underlaid with clay, on what is called a clay loam. Almost anything put

nto a solid clay bank, whether it is manure or anything else, will have very little effect upon it for a time. It must have time for the chemical changes to take place. I have ascertained to my satisfaction that there is no farm in the State of Connecticut that is able to carry cattle enough to make barn-yard manure sufficient to bring the land up to a high state of cultivation. Make all you will by composting and by keeping cattle, you will find that you will not have manure enough; and it is out of the question, in this tobacco-growing region, to pay such prices as our farmers are paying for manures from the cities. * * * * I maintain that there are salts enough in all soils to produce a crop at any time, even in a barren pine plain; that what it lacks is vegetable matter. It lacks what is called in chemistry geine, or humus, or leaf-mold. Restore this to the soil and you at once restore the source of fertility. Salts and plant-food put in connection create a chemical action, and they mutually supply the growing plant with food.

Our secretary has referred to some of our fields which are now barren that formerly produced good crops, and the reason is, that by continual cropping the geine, or leaf-mold, or vegetable matter, has been nearly all extracted from those fields. Is there any lack of potash in those fields? Not at all. Then let us see. The silicates of the soil contain potash, and the application of plaster breaks down the silicates and lets loose the potash. There is enough in the soil, but it lacks vegetable matter. Restore that, and you then set up what may be called a fermentation. In other words, you make the soil alive, and it is no matter in what form you put it in, whether it is in hay passed through your cattle, and put back in the shape of manure, or whether you put that hay into the ground without passing it through your animals.

I went to work after I got my tobacco-crops off, and instead of letting my ground lie perfectly barren for six months or more, I plowed it and put in the crop that I could make grow the quickest, so that I could use the land another year for another crop. I found that rye or wheat was the only crop that I could use for that purpose. Clover is the best crop, because it produces more, brings up the mineral matter from a greater depth, and leaves it so near the surface that other plants can feed on the material when the clover-plant is dead and decayed; but it takes clover two years to grow. I find rye the next best crop. By sowing a bushel and a peck of rye to the acre, immediately after my tobacco is off, I find it produces quite a rank growth during the fall, and in the spring, by the time I want to put my tobacco in, the last week in May, or the first week in June, this rye is all headed out and in blossom. I took a whole "stool," as we call it, from two of my fields, this last year, and the rye measured 6 feet and 8 inches from one field and 7 feet and 1 inch from another. * * * * The whole field would not average that, but it would average 6 feet and 4 or 5 inches, standing very thick and growing very rank. Well, what is the advantage? Have those plants affected this soil at all in the mean time? Have they benefited it any? Let us see. The mere presence of a plant growing in your soil helps bring up to the surface, and to store away mineral matter for the coming crop. It elaborates, in other words, plant-food for another crop that is to come after it. The very action of the living plant in the soil breaks down some of the silicates, and puts it into such shape that it will give up the potash and the other ingredients a great deal more than will be the case if you let it lie perfectly bare. Then, if we plow in that crop instead of taking it off, we have restored not only all the plant has gained from the breaking down of the salts of the soil, but what the plant itself has made from the atmosphere, and gained from the various ingredients; and in that way I hold that the soils of very barren fields can be entirely restored. * * * * * We must give up the idea that almost all the fertility of our soils is to come from the barn-yard. We must not skin our land, to begin with; and a man who takes off all his crops is skinning it, no matter what the crop may be. We must restore these elements to the soil. Take away the plant-food and you have barrenness; but in the soil are all the salts necessary to produce a crop at any time. If you have a clover-crop growing, a bushel of plaster to the acre will make a considerable change in it. Why? Because the very clover-plant itself decomposes that salt, if it is a salt, and the sulphuric acid and lime, let loose, act upon the geine of the soil, and the sulphuric acid acts upon the silicates, and sets free the potash, and your plant is nourished. In other words, you get up a round of chemical changes in the soil just by your manipulation of it, and the more you cultivate your soil the more plants you put into it, especially if you plow them in.

In reply to a question, Dr. Riggs stated that while it cost him about $50 per acre to prepare his land for a crop of tobacco, by plowing in green plants, it costs his neighbors on the rich tobacco lands of East Hartford about $300 per acre for manure.

Mr. Webb believed in turning under clover, rye, or any other green crop, as he thought the land was always benefited by it. Still, it was often a hard matter to get the consent of one's mind to turn under a crop of rye when the barn was empty and rye-straw was bringing $35 per ton; but there were cases where it could be abundantly afforded. It is often more profitable to turn under valuable crops than to con-

tinually carry them off the ground. He never had any difficulty in raising a good crop of wheat after a crop of tobacco. In reply to the question as to whether land would continue to produce well after three or four years' plowing in of rye and other green crops, he stated that the best effects he had ever seen was on an exceedingly poor piece of land treated in this way. A ter a light manuring, he raised a crop of corn, and then seeded down the land with small red clover. This was turned under in the spring, and corn again planted; after that, again manured, and the following year planted with potatoes, with fish-guano in the hill; then seeded to grass, and, for five years in successsion, he cut a heavy crop of hay. The land was a gravelly loam.

Professor Johnson said that green crops were especially adapted to the renewal of light lands. Where the soil is heavy, and contains so much water that it is sticky and plastic, and fit to make brick, green manuring would do no good. Such lands would be radically improved by another means—by the use of lime, which sometimes produces the most wonderful effect on stiff clay soils. With a top-dressing of lime, lightly harrowed in, the lime will gradually dissolve in water, and as the water penetrates the soil the lime goes down with it, is deposited in the clay, and intervenes its own particles between the particles of clay; and it will be found, after a season or two, that the plowing of the land can be undertaken earlier in the season. It dries off sooner, and acquires a loamy texture, while at the same time it is chemically improved. This was the treatment formerly given heavy lands in Germany; but thorough drainage is now regarded as the best and only permanent remedy for the wetness of heavy lands. As to the importance of green manuring on sandy soils, Professor Johnson said:

This matter of green manuring is exceedingly important for our Connecticut agriculture. There are villages and districts in Belgium and North Germany, having dense populations, where the country has the appearance of a garden, which, within the memory of man, were as barren as any of the land which you may see in the neighborhood of North Haven. The improvement of those lands has been accomplished not by any means exclusively by plowing in green crops, but that has often been one of the strong points in their renovation. Take the most barren piece of land you can find and fill it with vegetable matter, so that it will hold moisture, and so that the roots of plants may find a congenial place to develop themselves, you will make them capable of producing crops. There is no soil (speaking generally) so barren that it cannot be put on the high-road of improvement in that way. Fertility comes to it, not from anything which is obtained from outside, with the exception of nitrogen and other atmospheric elements, but from the soil itself, which is made available by the action of vegetable matter upon it. * * * The plowing in of green crops on light, sandy lands, has an analogous effect. You do not, indeed, thereby add anything to the mineral elements of the soil, but you set at work, as Dr. Riggs has said, that train of chemical changes which makes a soil out of the sand. All our soils were once merely rock fragments or rock-dust, and if we repeat the processes which have converted rocks into soil, we shall produce soil. We can make soil out of sand by plowing in green crops.

There is also a great deal of point in what Dr. Riggs and Mr. Webb have said about the importance of keeping the soil occupied by vegetation. There is one element of our crops that must be presented to them by the soil; one which is the most costly ingredient of our fertilizers, that easily runs to waste. It is what we call ammonia, or, more accurately, nitrogen. That is what makes Peruvian guano, urine, and other animal manures, like blood, flesh, and the combustible matter of bones, act so energetically. When we put nitrogen into the soil, in the shape of animal fertilizers, if the soil be open and porous, so as to admit air and water, we have, in warm weather, a rapid alteration of this nitrogen. It is converted into nitrates, which are freely soluble in water, and are not retained by the soil, but are carried off by rains. Wherever the soil is fertile and capable of sustaining vegetation, whether naturally or by manuring, there the formation of nitrates is continually going on, and when there is no vegetation to take them up, they wash away in the drainage.

Then, again, the rains carry off large quantities of lime and sulphuric acid, both of which are freely soluble in water. * * * This thing is going on constantly, in many soils. The water that passes through the springs and drains on every good farm, always contains lime and sulphuric acid, and those elements are incessantly being washed away from our

land. Look at our tobacco-fields and market-gardens; they must be fertilized every year, at great expense. Mr. Olcott says that $40,000 worth of fertilizers were used last year in the Silver Lane district, near Hartford, alone. The chief commercial value of these fertilizers lies in the nitrogen; that is what this large sum of money went for chiefly. Suppose that land lies unoccupied by vegetation; every rain that falls carries off the nitrates, the lime, and sulphuric acid, in large quantities. If the fields are covered with vegetation, the current is going the other way; the plants are storing these materials up and keeping them from waste. In that respect alone, the growth of green crops on tobacco-land, or any land that is rich, serves a useful purpose in retaining a good share of whatever has been put there by fertilizers.

The doctrine that the farmer must put back upon his farm as much as he takes off, was denounced as nonsense by Professor Johnson. He said that those elements taken up in the growth of vegetation and removed from the land cannot be restored. Crops are made in part from the soil, and if they are exported, a portion of the soil is exported with them. While it is essential that every farmer shall export something from his farm, the wisest policy would be that which reduces exports to the minimum and increases imports as much as possible. In all good agriculture there must be an export of the elements of the soil; but, while this is the case, there is really no danger of an exhaustion of the elements of fertility. Time was when all our soil was rock, and the process by which this was converted into soil is still going on, and new materials are furnished as the old materials are used up. A part of the farmer's art is to intensify this process of solution and weathering, so as to bring the rocky matter of the soil into material that will feed a crop. Farms should be measured, not alone by superficial, but also by cubic measure, as their value depends not so much upon the number of acres they contain as upon the depth which crops can fill with their roots.

Professor Johnson concluded by saying that the one grand mistake in agriculture, the world over, in the early stages of the development of any country, was in spreading ourselves over too much surface. There is positive merit and positive gain in concentration. Land should be brought to such fineness and depth of tilth, such retentiveness of moisture, and such richness in all the elements of fertility, that the soil will insure a crop under all the ordinary vicissitudes of weather. That was one of the glories of the tobacco-field, and for the lesson it teaches in the art of enriching the soil, he thought it ought to be encouraged. The great difficulty lies in working too much land. It is like going out with a pint of paint to paint a forty-foot barn. Both your manure and your labor are used at a disadvantage when applied and expended upon too great a surface. Concentration in the use of both labor and fertilizers is the surest road to successful farming.

Professor Atwater followed with a very interesting paper on the subject of "commercial fertilizers at home and abroad." Having spent several years in the agricultural colleges and experimental stations of Germany, Professor A. devoted a large portion of his paper in illustrating the thoroughness of experiments made at these institutions, and the great value of the results obtained to the agricultural interests of the whole world. In discussing the merits of the more popular kinds of commercial amendments, he laid down the following rules or principles for determining the value of all fertilizers:

1. The amount of increase in production which will result from the use of a given artificial fertilizer in a given case depends upon the amount and quality of the active fertilizing ingredients it contains, on the one hand, and the conditions of soil, climate, and crop under which it is used, on the other. The latter factors are so uncertain as to render the actual solution of the question of profit, the determination of the agricultural value of a fertilizer, possible only by actual experiment in the field.

2. The value of a fertilizers is dependent upon the amount of fertilizing ingredients it contains; the commercial value can be determined by no other means than by chemical analysis. The readiness with which their fertilizing elements will become useful to the plant, an important factor of their commercial value, is largely dependent upon their fineness of pulverization, and their solubility in water. Scientific and practical experiments indicate, for instance, that steamed and very finely pulverized bone-dust is worth at least a third more than coarsely pulverized bone. Practical German farmers often pay twice as much for the former as for the latter. On the same grounds, phosphoric acid is considered worth two or three times as much as superphosphate, that is, in the soluble form, as it is in the insoluble form. The greater worth in these cases is due to the greater quickness with which these substances become assimilated by the plant, and hence the quicker return of the capital invested. In general, the only fertilizing substances whose real value bears such a proportion to the prices at which concentrated fertilizers are usually sold as to allow of their being taken into account in the estimation of the values of the latter, are nitrogen, (as ammonia, nitric acid, &c.,) phosphoric acid, and potash.

3. The chief defects of the artificial fertilizers sold in the United States are the small quantity of soluble phosphoric acid in the superphosphates, the rather small content of nitrogen, and in many cases the lack of fineness of pulverization. With a little more acid applied in the making of superphosphates, to render the phosphates soluble, a little more nitrogen added, sometimes a little finer grinding, and, in the case of bone-dust, a thorough steaming of the bones, and omitting a reasonable portion of the ballast of water, sand, and plaster, which they contain, our fertilizers would compare favorably with the best foreign articles. This is true of the better, the standard wares. As regards cheaper mixtures with which our markets are infested, the consumer would in general be able to buy the valuable fertilizing ingredients in other forms, compost them with dirt, muck, and farm-refuse, and thus obtain a much more valuable article, at very much, sometimes five or ten times less cost, than in the form of poudrettes and special fertilizers.

4. The only security, as well for the upright dealer as for the consumer, against the evils resulting from the sale of inferior articles, is that guanos, superphosphates, bone-dust, and in fact all artificial fertilizers, be sold at prices based upon warranted percentage of nitrogen, soluble and insoluble phosphoric acid, or other valuable fertilizing ingredients. The surety for these percentages must be sought either in the guarantees of reliable dealers—such guarantees as would be valid for bushels of wheat or yards of cloth—or, still better, in analyses, made by reliable chemists, of the wares to be purchased. When dealers sell their goods and farmers buy them on this plan, the preference given to good wares will encourage manufacturers in making them, and will tend to banish poor ones from the market.

5. The measures taken by Boards of Agriculture in publishing results of analyses of current wares, and of legislatures in making laws for the regulation of the sale of the same, are steps in the right direction. The only practically reliable security for the just regulation of this trade, however, lies in the vigilance of consumers themselves. Whoever buys any article of whose quality he is uncertain, must expect to be cheated.

To make this vigilance practicable, Professor Atwater says it will be necessary to provide means whereby fertilizers may be analyzed without too much trouble and expense to the consumer. If such means of improvement could be inaugurated here as has been made in England and Germany, the saving to our agricultural communities in the cost of fertilizers alone would amount to hundreds of thousands of dollars annually. As the practice now exists, fertilizers are sold by the barrel or ton, but what is sold as such is a mixture of valuable and worthless ingredients, whose proportions are too often either entirely unknown, or assumed upon untrustworthy grounds; and neither maker nor user, merchant nor farmer, can hope for a better state of things until measures are taken by which the valuation shall be based upon valid factors actually and certainly known to both parties. Many years of irrational cropping have so far exhausted the fertilizing elements of the soil in many sections of the country that it can no longer yield the bountiful return that once rewarded the husbandman's toil. The products of the barn-yard and stable alone, even if properly economized, are insufficient to supply this lack, so that, in order to get full crops, artificial fertilizers become a necessity. Rightly to select, as well as rightly to use these articles, requires knowledge and application of scientific principles. Whatever is done must be done by the farmer himself, or through a combination of those interested in his calling. Plant nature and human nature are about the same the world over, and the condition of the fer-

tilizing market can be improved only by the same means that experience, as decisive as it is costly, has forced into use on the other side of the Atlantic.

In reply to a question from Mr. Clift as to whether steamed and pulverized bone, applied in the shape of a fine powder, is not all used up in one season, or, if not entirely exhausted, if the remaining nitrogen is retained for the next year and crop, Professor Atwater stated that Wolff, of the celebrated agricultural school at Hohenheim, had demonstrated by experiments that very finely pulverized bone-dust, such as is made in Germany from steamed bone, and is as fine as flour, will produce favorable effects upon crops for two or three years, and possibly a little longer. With coarser ingredients, the effects will be observable for three or four years. Bone-phosphate that has not been superphosphated, cannot all be used up in one year, but in general may be relied upon to last from three to four years or more.

In reply to a like question from Mr. Linsley, Professor Johnson said:

There are two fertilizing elements in bones: one is phosphate of lime, the other is animal-matter, nitrogen. Now, the phosphate of lime—phosphoric acid—is a thing that wastes very slowly from the soil, ordinarily. If you examine the water which flows through the soil and is accessible in a drain, well, or spring, you will never find enough phosphoric acid in it (unless it comes from the vicinity of a privy, a barn-yard, or a cemetery,) to cause any alarm on account of the waste of that material. On very highly fertilized soils, which are underdrained—a tobacco-field, for example—you find, in the wash, traces of the phosphates, but in soils which contain the ordinary amount of phosphates, you will find nothing which need cause any apprehension of deficiency or loss.

The case is quite otherwise with nitrogen. The nitrogen of our soils is a thing which is undergoing constant changes. It is coming into the soil from the atmosphere, and going out of the soil into the ocean. The process of decay also passes nitrogen directly into the air, and when that process takes place, with exposure to air, you may have a washing out of nitrogen in the form of nitrates from the soil, so that animal matter is constantly wasting. You cannot save all that is put into the soil. The water that washes through the soil carries some of it off. Therefore, the cheapest way of using a fertilizer is to use it so that its effect shall be given when your crop is coming. The more active the fertilizer the more economical may be your use of it, if you know how and will take pains to use it properly.

Mr. Albert Day read a paper on the subject of barn-yard and stable manure, which was followed by quite a long discussion. During the progress of this debate, Mr. Beard spoke as follows in relation to the importance and value of muck as a fertilizer:

I have used mucks in various ways, and made many experiments. I have carted muck and put it under shelter, and had the females of the house empty the chamber-vessels on to that through the winter, and have obtained a very powerful manure, so much so, that when I put it on top of potatoes it killed them; they never came up; but when I put it under the seed, they did well. In one instance I put some four or five loads of muck, right out of a pond-hole, in a dry summer, on to a pasture, and the result has been to make a fresh growth of grass there for a number of years. I do not know but that muck has shown its effects on that piece of pasture-land for more than twenty years; I think it has. I have carted muck and laid it in the open air back of the house, where my people could empty their various washes on it during the winter, and then used it in the hill, mixing gypsum with it, which made a very excellent show. I have used it on potatoes and corn with very good effect, and so I have also on tobacco. I am, therefore, satisfied from the use I have made of it—and I have been using it more or less for some twenty years—that it will pay to cart it out in the winter or fall, and spread it on the land, and let the frost act on it, and use it in its raw state. It tells well, also, to cart it into the barn-yard, and let it lie there to receive the droppings of the cattle during the day.

Mr. Fowler made the following statement as to the results of his experiments in top-dressing:

I have for several years past practiced top-dressing. I use almost all the manure I make upon the surface, either upon meadow or upon plowed ground. The greater part that I use on my meadows I keep in the yard during the winter season; in fact, I make manure in my yard and stables during the entire year; but I apply it directly to the soil. I have practiced hauling my manure out of the stables and dumping it in piles. I allow it to remain there, without handling it at all, until a short time previous to applying it. The piles are not cov

ered, but remain there exposed to the weather. I have been obliged to keep it mostly outside, exposed to the weather, not having buildings convenient to keep it under cover; but I have stacked it up, and in the winter, or any time in the summer when we had a dull day, I would let my men fork over the manure, in order that decomposition might commence; and I cannot see that the manure loses any more of its virtue, with the exception of a little on the surface, than it would if kept under cover. Then I fork it over once or twice, and spread it over my meadows just as soon as possible after haying, let the weather be what it will. It receives the fall rains, and the aftermath springs up directly through it. I get a large growth of aftermath, or rowen, which holds that manure, and I have never supposed that I lost much by washing or draining. I have realized very good results. I have always had good crops of hay, and also of corn, particularly this last season. I plowed my sod or turf-ground in May, (it was quite late before I began to plow,) and put my manure, which at that time was thoroughly mixed, on the surface, and harrowed it in. I put on a heavy coating of manure, and had very good results. I think I had the past season as good a piece of corn as I ever raised, while my neighbors around me, who plowed in their manure, suffered very much from the dry weather; and I can show more than double the quantity of corn upon the ground where I top-dressed than my neighbors can upon ground where they applied as much manure and plowed it in.

Professor Johnson said:

You have had here to-night, as you always have had, and doubtless will have for a long time to come, opposite experiences, and yet there are necessarily good reasons, as we all understand, for the differences in our experience. Fresh stable-manure contains some 70 per cent. of water, 25 per cent. of vegetable and animal matters, and 5 per cent. of salts and mineral substance. If we put it on a cloths-trainer, and slowly wash it with the rain of a watering-pot, we shall dissolve out a portion of the organic matter, (some 2 per cent.,) and a portion of the salts, (some 4 or 5 per cent.,) and we shall, besides, drive through the cloth some of the fine particles of the manure that do not actually dissolve; but the coarse parts will remain on the strainer. The same happens on the ground. The most active fertilizing elements are carried into the soil in solution, the undissolved matters which exist in a state of fine division are mechanically carried into the soil to an extent depending upon its porosity, while the coarse matters—the straw of the litter—remain on the surface.

Now, what happens to the dissolved matters, consisting of humic acid, which gives the brown color to dung-liquor, and of carbonates, phosphates, and sulphates, of ammonia, potash, lime, magnesia, and soda? Are they liable to run to waste? No more, it would appear, than if the manure was buried in the soil. Not so much, in fact, as in the latter case, because they have more soil to pass through before they can escape into the springs. If the soil is fine in texture, has enough fine earth, or rather that retentive power over the soluble matters of manure which resides in the fine earth, and which enables good soil to filter out and hold in its pores these soluble matters, so that you can put dung-heap liquor into a leach-tub half full of such earth, and pure drinkable water will run out below, then you need fear no waste. But if the soil is coarse in texture, and water runs through it very rapidly, and dung-heap liquor is not much clarified and sweetened by passing it, then the manure may suffer decided loss.

Yet again, in case of the coarse, open soil, if it be full of grass-roots or grain-roots, which are ready to absorb the dissolved matters as soon and as fast as the spring rains descend, you may lose, indeed, some manure; but you may also do well to lose a part of it, in order to put another greater part where the growing crops will be certain to pay back for all the expenditure and give a margin of profit besides.

On light, unretentive land, bare of vegetation, do not apply manure to the surface during the winter. A principal benefit of stable-manure to such soil consists in mixing with the bulky, insoluble matters of the dung and litter which are of the most porous and moisture-holding character, and which operate to counteract the leachy and droughty qualities of the soil. On such land hold the manure in reserve, carefully protected by cover if practicable, and bury it in the soil where the pushing roots of the new-sown crops will find it, and where it will be food to the plant not only, but drink also, in virtue of its hygroscopic nature, all the summer through. The presence of abundance of stable-manure in such a soil enables it to hold a much greater proportion of the rain that falls upon it; less rain runs off into the streams; there is less leaching, therefore, of plant-food; at the same time there is increase of plant-drink. This point can only be appreciated when we know that the evaporation of water through the foliage of crops amounts to 5,000,000 pounds per acre every season, and must go on whether there is rain to supply it or not.

After having, by any proper system of management, so altered the texture of leachy soil that it will hold almost all the water that falls upon it; after having incorporated with it vegetable matter in considerable quantities, and mixed it with coal-ashes—leached ashes, perhaps—so that the soil has a great many fine pores, and so that the rain penetrates it slowly, and but little runs away altogether, then we have practically a different condition of things, and need not fear loss by drainage. The more the soil approaches that state which is implied by the term "loamy," the more we can risk our manure upon the surface when the crop is not there.

One effect of the surface-application of manures upon soils which are in grass or occupied

with crops, or upon soils not thus occupied, if they are retentive of the element of fertility, has been mentioned by Dr. Hatch. That is, a decided effect on the texture of the soil. The German farmers have a special word for it; they call it "fermentation," and have written books upon it. There is a kind of texture which is proper to land in good condition, something like that which you find in a well-cultivated garden. It is a thing which is rather difficult to describe; but, when you once understand what it is, you can easily identify it. It is a sort of mellowness of the soil. If you take up a board which has been lying in a walk, you will see a difference between the soil underneath that board and the soil close at hand. There is a friability, a fineness, or something about that soil which is apparently very agreeable to the roots of plants. Dr. Hatch remarked that sod upon which manure had been lying during the winter broke up more easily and was a different sort of thing from sod where this had not happened.

This quality depends chiefly upon the protection which the cover, be it board, stone, or manure, affords against the dashing of the rain, which compacts and puddles the surface, and against the drying effects of sun and wind, which tend to form a crust. The shelter keeps the earth uniformly moist, and as friable at the surface as it is below, or as its nature admits. It also favors the burrowing of earth-worms, grubs, and other insects at the surface, which otherwise must go deeper to enjoy the moisture they require. This shelter, then, of surface-strewn litter is a cheap tillage, or takes the place of tillage to some extent, and on soils of a certain texture is very favorable, or at least it is thought to be by many intelligent practical men.

Professor W. H. Yeomans read an exhaustive paper on the subject of night-soil, in which he gives in detail the various modes of composting and preparing it as a fertilizer. A practice which he has followed to a considerable extent, and one which he recommends to all, is to furnish a quantity of earth and compost-material, depositing it under cover, and of easy access, where the slops of the house are daily deposited, and so absorbed. When the same is sufficiently saturated it can be removed, and the operation repeated, being careful to have it fully prepared before the setting in of winter. Another method is, instead of placing the absorbent in a pile, to put it in barrels, into which the urine is to be poured, and which can be emptied as desired. Some years since he tried this method, by filling, at the commencement of winter, a barrel with coal-dust, upon which urine was poured, until the same was thoroughly saturated and frozen solid, when it was abandoned. In the spring the same was used to plant corn by putting about one pint in the hill, dropping the corn directly upon it. The result was, that hardly a spire of corn made its appearance. It had been as thoroughly killed as it would have been with the same amount of the best guano. He planted the piece over, however, by striking into the hill with the hoe, dropping in the corn, and again covering. This time the corn came up, grew vigorously, and maintained throughout the season a dark, green, rich color. Another season he tried chip-dirt, saturated in the same manner, side by side with superphosphate, with very nearly equal applications in quantity, and could discover no appreciable difference in the growth of the corn or in the general result. Of the two, that where the urine was used, as in the previous case, was of a deeper and richer color while growing.

Mr. Gold gave the following method for the preservation and preparation of night-soil:

I made a tight box of plank about fifteen inches deep, which I put under the privy, which opens broad and flat to the rear into a room adapted to preserving and storing dry earth, and also the contents of the box. In the privy I keep a barrel of dry earth, sifted coal-ashes, or something of that kind, which is thrown upon the deposit in the vault every day, at least, and oftener, if necessary; and the contents are removed and thoroughly mixed with the dry earth, which is also thrown in from the rear as often as once a week, and piled up in the building. The arrangement is a very simple and cheap one, and, so far, promises very good results. I find no trouble from odor; it is thoroughly restrained by the application of the dry earth or sifted coal-ashes. You know that when nothing of this kind is used it becomes compact and forms large masses, difficult and unpleasant to separate and spread in the field; but the application of the dry earth forms an excellent division, so that when the deposit is removed it can be done without offense, and may be manipulated and worked over without difficulty and piled up in a very convenient form for application.

Speaking of the value of night-soil as a fertilizer, Mr. Clift said:

I have been in the habit for five and twenty years of utilizing night-soil—taking the contents of the privy as prepared, and spreading them in the garden, upon my mowing-fields, and using them in the cultivation of almost all kinds of crops, especially garden-crops, and I have eaten and my family have eaten very freely of the various kinds of vegetables and fruits that have grown on this soil, which is pretty thoroughly saturated with night-soil. I have never discovered that it has done me or them any harm. The celery that is grown with this kind of fertilizer I know to be of very fine flavor, and I prefer to use it rather than any other in the cultivation of celery in trenches, where the application has been not only of the solid contents of the privy, but the liquid manure, of course very greatly diluted, applied to the growing crop. It makes very good celery, it makes good potatoes, it makes good sweet corn, good cabbages, good turnips, and good everything that I want to grow in the garden; and if it has done my family any harm, I have never found it out.

Dr. Riggs spoke as follows of the earth-closet system and the value of night-soil when prepared in this way:

The earth-closet system is true in theory, and it is true in every way; but, unhappily, it has never been applied until lately, and now not perfectly. The vaults of our privies should be so arranged that they should be regular manure-factories, and so that a man can go into them in the winter time and manipulate the manure by mixing dry earth with it. This earth—no matter if it is nothing but light, loamy soil, what we call yellow dirt, it is just as good—should be dry. When it is dry, it mixes with the night-soil and deodorizes it completely, so much so, that you could carry it in a snuff-box and present it to your neighbor, and he could not tell of what it was composed. Now, other manures should be deodorized in the same way, but night-soil especially should have that treatment, and should be saved, as was suggested by the author of the paper which was read this morning. The cellar for the composting of that material should be so arranged that it can be easily removed; we should have it under control. I would not place any lime in that chamber of night-soil except in the form of sulphate of lime. Coal-ashes have considerable alkali, but it is in the form of carbonate of lime. The composition of coal-ashes is carbonate of lime, alumina, and oxide of iron—valuable as far as it goes, and very valuable on light, sandy soil. Like the application of other carbonates, it makes light land heavier and more adhesive, and it has the contrary effect on clays; but I should not compost it with any manure any more than I would lime. A point in which I think they are lacking in the stables we have visited, although the management is excellent, is this; the manure lacks packing. It is the carbonate of lime that causes that evaporation or the development of gases, and if it was thoroughly packed by those pigs, (that is their true field of action,) they would find their manure much richer and much stronger when they undertook to get it out than they will under the present arrangement. That has been my experience. I have tried lime in compost heaps where there was nothing but vegetable matter, and it is very valuable, but in night-soil it is perfectly destructive to its fertilizing qualities; that is, in the main. I think it causes loss, so that it is not as good, or certainly no better than road-scrapings, or the soil that we get by the side of our fences. I think that we ought to have a proper reservoir made, not merely large enough for the excrement, both liquid and solid, to be kept during the year, but to give room for its manipulation, by throwing on this dry earth to deodorize it. Copperas, sulphate of iron, is very good, better than anything else, to deodorize a vault. You may take the strongest manure, and put in a few quarts of pulverized copperas, either in the form of a solution or a fine powder, and it will deodorize it so completely without any earth at all that you will hardly know what you are shoveling. It is better than plaster in a cellar like the one of which I am speaking. It costs more, but you can buy it by the quantity at about a cent and three-quarters or two cents a pound. You will find that copperas-water, or copperas sprinkled over it, will deodorize it so completely that your men will not object to working in it.

Mr. Weld, of New York, gave his method of securing and preserving the contents of the privy as follows:

I think a vault is a nuisance. There is a box which slides under the privy, which I originally had on runners, but I found it more convenient to knock the runners off and slip the box on a stone-boat and carry it off. The box is 4½ or 5 feet long, 2 feet wide, and 14 inches deep. There is a constant supply of dry earth kept in the privy, and when any member of my family uses the closet, a dipper of earth is thrown in. It is not a very disagreeable thing to do, nor is there anything disagreeble about keeping the box clean. The stone-boat is brought down, the box is raised by a crow-bar, for it is rather heavy to lift, the stone-boat shoved under, and the box is carried off, and the contents put on the top of the ground, or worked right into the garden. The manure does not deteriorate if left on the surface. The box is emptied a good many times a year, although I have but a small family. And the more dirt goes in the better it is, it strikes me. It works easily. I frequently go in, and to the disgust of the man whose business it is to keep the earth-box full, throw on half the contents of the box so as to be sure to have dirt enough. It is always crumbling, so that there is no trouble about applying it.

As to the use of coal-ashes, I find that coal-ashes alone do not do very well. Even in the winter time if coal-ashes are used and there comes a warm spell, there will be a little too much disagreeable odor, and we are so free from odor that we are fastidious. But even with coal-ashes alone there will be nothing like the odor from an ordinary privy. But coal-ashes mixed with one-quarter earth are perfectly efficacious in cold weather, and even in warm weather. Coal-ashes mixed with wood-ashes we do not use at all; we only use the coal-ashes that come from base-burning stoves, where the fire is not kindled every day. I should think that a moderate per cent. of potash would interfere with the effect of coal-ashes seriously. I consider that earth mixed with the manure in that way does not interfere with that kind of fermentation which would destroy any seeds of disease which might be in the manure; and I presume that if the London sewage could be in any way caused to ferment before it is applied to the grass, there would be no difficulty, except what arises from the application of too much of anything which produces excessive growth; and it is a question whether the typhoid fever of London, which is said to be caused by the milk, is not due to an excessive application of manure causing an unhealthy growth of vegetation, which produces similar effects.

In regard to the saving of liquids, chamber-lye, and such things, I think that certainly they ought never to be mixed with solid manure, because it makes such a disagreeable thing to handle; but if a load of muck can be placed under cover somewhere, where the chamber-pail can be carried, or even a load of ordinary stable-manure, it will absorb an immense quantity of chamber-lye and slop-water. It had better be composted afterward, unless you want to use it very rich.

Professor Johnson said:

In saving night-soil by the earth-closet system, the earth must be fine and dry, and enough of it must be used each time to take up all the liquids, so that the mass always appears dry on the surface. I have used the ashes of anthracite and of Franklin coal with entire success. * * * The manure thus made is not concentrated, and does not compare at all with guano, for the reason that the four ounces of fæces and the pound of urine supplied in one stool receive, I should say, some two pounds of earth to absorb and deodorize them, while the fæces contain but 1 per cent. of phosphoric acid, and 1.5 of nitrogen, and the urine but 0.6 per cent. of nitrogen, and not more than 0.1 of potash and 0.5 of phosphoric acid. These quantities simply manure the earth used to defecate the excrement. In a sample of earth that had been passed six times through an earth-closet I found but 0.17 per cent. of phosphoric acid, 0.09 per cent. of potash, and 0.24 of nitrogen, of which last one-third was in the form of ammonia, or passed into that form on treatment with an alkali. Dr. Gilbert found that such use of earth by generously-fed persons increased its proportion of nitrogen by about 0.15 per cent., the earth being used in such limited quantity that it remained moist throughout. Dr. Voelcker found that soil from the earth-closet of a prison gained about 0.7 of nitrogen with each repetition of its use; the gain of phosphoric acid was 0.11 per cent.

The limits of this work forbid further quotations from many other able and valuable papers contained in this report. The address of Professor Johnson, the essay of Rev. William Clift on the subject of "Marine Manures," the discussion on the general subject of plowing in green crops for manure, and the value of salt, lime, ashes, gypsum, or other mineral fertilizers, bones, guano, superphosphates, and other commercial fertilizers, will all have to be passed over with this very brief mention.

RECENT RURAL PUBLICATIONS.

Department of Lands and Agriculture—Victoria: Second Annual Report of the Secretary for Agriculture, Melbourne. By authority. John Ferres, Government printer. 1874. 364 pp., 8vo.

Subjects treated, style, printing, binding, illustrations, *all* make this report a credit to those engaged in its production, especially when it is remembered that the colony only dates back to 1788, and that the office of "secretary of agriculture" was created only eighteen months before this report was issued. Coming from that remote Australian world, of which Victoria forms only the southeastern portion, where not only the

seasons, but much of nature beside, are the reverse of ours, this report is strangely interesting to us. We are often recalled to note that their spring is our fall, and their summer our winter, and to wonder at differences in our climates; yet similarities in some fruits and products, and wants similar to ours to make their department more effective in extending its benefits and increasing agricultural knowledge and skill among the farming classes, make them seem not so very strange after all. In that newer field and younger department we find passages of experience like our own, and see that already are they learning the evils of continual cropping, and dreading the cost in time, labor, and money needed to restore the earth's productiveness by a better system of tillage and plentiful manuring. The management of farmers' clubs, and fairs, and best modes of encouraging improved cultivation by prizes, are also considered. Appeals are made for increased force in the department; for establishing an agricultural and botanical museum; and for an experimental farm, where foreign seeds and plants may be tested under the supervision of the department itself. Wishing it success in all these directions, we turn to the subjects treated in the report.

"Hop-culture is making rapid strides in Victoria;" but with a prospect of requiring frequent renewals of the plants.

Flax culture has not yet been satisfactory. "Failure has been attributed, generally, to the excessive dryness of the spring and early summer months, and the frequent recurrence of hot winds," to which are added "the scarcity of labor, and the want of implements to supersede hand-work in the operations of harvesting and after-treatment." "The improved flax-pulling plow," by Mr. Gray, of South Australia, is commended; but as premiums of £150, £100, and £50, respectively, are offered for flax-harvesting machinery, we suppose it is not all that is desired.

Vineyards flourish, free from disease, (except occasional "black spot" and *Oidium tuckeri*,) and especially from that scourge, the *Phylloxera vastatrix;* and as the vines increase in age, the wines bid fair to equal, if not excel, the best wines of Europe.

The manufacturers of beet-sugar have not yet been able to secure the government premium of £5,000, less than 100 tons being produced "by any one factory, from beets grown in Victoria;" whereas 500 tons are required, or at least 100 tons for a proportional part.

The first silk-worm eggs (called "grains") were introduced by Mrs. Neill, in 1873; and though successful, there has not been sufficient time for much progress.

Wool-growing is an important interest in Victoria, as in Australia generally; but is menaced by the increase of parasitic diseases among sheep, especially the fluke-worm, hydatids, and, latterly, a stomach "thread-worm," (*filaris.*) The causes assigned are increased humidity of some seasons; fencing "runs," so as to confine the sheep to infested pastures; and extirpating salty and bitter herbs by overstocking, or by introducing tame grasses. Remedy and prevention are to be sought in drainage, in the restoration of bitter and saline plants, (hoarhound is specially named,) in abundance of fresh and clean pasturage, and in dispensing with dogs, whose "droppings" contain eggs of the parasites. For cure, the following medicines are prescribed: Dissolve 12 ounces niter in 100 ounces water, to which add 50 ounces sulphur. Stir well, (as sulphur is insoluble,) and give a one-ounce dose four times, at intervals of ten days, the sheep to be allowed access, all the time, to a mixture of salt with 10 per cent. of sulphate of iron. "This remedy has proved marvellous in its results, every sheep which has been treated having

recovered." In another case, one gentleman "lost last year £10,000 worth of sheep; this year under treatment, his losses have been under £10." The other effectual remedy is, make as strong a decoction of hoarhound as possible, by boiling the herb well; and with a bullock horn give each sheep a wine-glass full on an empty stomach, three or four times, at intervals of three days. The salt and sulphate of iron is to be used with this remedy, which has proved a specific, also, in all cases of worms. It was first suggested by noticing that sheep in a paddock where there was abundance of hoarhound were healthy and strong, while most of the others were badly affected, another hint to supply pastures with plenty of such bitter and salty herbs as sheep will eat.

The following native grasses (handsomely illustrated in the report) might prove worth a trial in some sections of our country. We condense the descriptions, and remind the reader that their summer is our winter.

Poa Australis—Broad-leaved meadow-grass.—Perennial; flowers in December; average height at time of flowering 3 feet; leaves smooth, flat and very long. Thrives on rich soil, in high, cold, and dry situations. A nice tender grass when young. The herbage is of little value when suffered to grow old. If grazed or cut down close every year, it would afford a good supply of valuable winter food.

Festuca dives—native oat-grass.—Perennial; in flower during December; general height 6 feet; grows on the Australian Alps and the mountainous country east of Melbourne. Although a large plant, every portion of the leaves and stem is succulent and tender, and it does not grow in coarse tussocks. On rich land it ought to yield a very large crop of hay; for which it is better adapted than grazing. The writer is of opinion that when cultivated, it will be one of their best fodder-grasses.

Dichelachne crinita.—Perennial; flowering in December, and seeding freely. In favorable (that is, rather dry) situations, this grass grows over 3 feet high, standing the heat well. It is an excellent pasture-grass, thrives well with kangaroo-grass, and flowers about the same time. The two make excellent hay, or, if grazed, a very fattening mixture.

Danthonia racemosa—Bunch danthonia.—Perennial; usual height of stem 1 to 2 feet; flowers in December, sometimes earlier; a good seed-bearer. This is the principal grass of which a large portion of Victorian pastures is composed. It is very hardy, and bears overstocking better than any other grass. If attended to, it would make a close turf. Its nutritive properties are considerable. It appears to thrive with rye, grass, and clover, which many native grasses will not do.

Anthistiria Australis, A. ciliata—Kangaroo-grass.—Perennial; average height under 3 feet, but on rich, unstocked land much higher, with strong, penetrating, fibrous roots; in flower during December. It forms generally but few perfect seeds, and these do not germinate readily. It is the finest and most useful of all the indigenous grasses. It begins to vegetate early in November, when all stock should be taken away until it is in flower. From that time until winter it proves an excellent fattening grass. It keeps green during the summer, but turns a little brown in autumn, when its nutritive qualities are at the highest. With a sufficiency of this grass, a little turned by the sun, the working power of horses and cattle can be taxed to the utmost. They keep in better condition, doing hard work, on this than on any other description of native forage. If closely grazed by sheep or cattle all the year round it soon dies out.

Paspalum dilatatum.—A perennial, rather late springing grass, with plenty of radicle leaves; roots numerous, strong, penetrating; stems about 2 feet high; begins to flower in January, and continues to produce seed until the end of March; keeps green during the hot weather. This, in my opinion, is a very valuable grass; * * , a first-class grass for grazing purposes.

Poa Brownii, Eragrostis Brownii, is said to produce abundant foliage, to keep its verdure during the driest summers, to be a good fattening grass, and to bear hard feeding.

The following table may serve to show the general character of the climate, and especially the extremes of heat and cold, and the amount and times of rain-fall, to which the foregoing grasses are usually subjected. The climate of Melbourne, where the observations were made, is approximately that of Victoria.

The following table gives the maximum and minimum temperature, (as shown by a self-registering thermometer, in the shade,) and the rain-fall, for each month in 1873, at Melbourne, Victoria:

Date.	Maximum temperature.	Date.	Minimum temperature.	Mean temperature.	Rain-fall.
January 20	101.0	31	47.1	65.8	2.068
February 16	102.4	1	49.1	68.0	4.667
March 5	95.2	24	43.4	62.8	1.836
April 7	85.1	28	42.2	61.2	2.067
May 8	70.6	29	37.6	56.0	1.310
June 1	68.0	16	37.0	53.4	2.688
July 31	63.9	18	30.2	47.8	1.399
August 28	71.5	15	39.6	52.9	2.072
September 28	79.5	1	34.5	54.6	2.572
October 16	89.8	5	35.6	59.7	2.921
November 4	84.0	12	42.6	58.3	1.409
December	101.2	14	44.9	67.3	0.593

The following, on agricultural education by the state, is conclusively stated:

It is high time, now that the church, the law, and the sword have their colleges supported by the state, that the plow should have hers; for I contend it is as much a matter of national policy to teach the people how to feed men scientifically as to kill them; and that a knowledge of how and upon what we subsist is as essential to the moral well-being of a nation as is a knowledge of divinity and law. The instruction of the rural classes in the principles which govern the practice of agriculture is a subject which I would commend to your serious consideration.

And the following, on the taxation of the farmer's land instead of his skill and industry, is suited for "all meridians." The secretary proposes a classification of lands, "according to their *natural* capabilities," as a basis for assessment and taxation, and adds:

It seems to me a monstrous thing that a man who, by the combined application of industry, capital, and intelligence, has converted a barren, schistose hill into a well-managed and productive vineyard, should be subject to a higher assessment than the person who owns or occupies the adjacent lands of equal natural fertility, or than one who owns a vast extent of the most naturally-productive lands of the colony, because such lands are devoted to none other than pastoral purposes. It seems to me that under such a system a man's industry is taxed, not the land, which, by the application of such industry, is made to produce a higher return per acre than lands of equal or even greater productiveness. This subject is one which demands attention; for it lies at the foundation of the unlocking of a vast, and, in the highest degree fertile, extent of territory, and its application to more profitable ends.

Such a system would hold out rewards to the industrious and skillful, and be "whip and spur" to the listless and indolent land-owners of wild and badly-tilled lands, whose would be the heaviest taxes and smallest products.

The secretary notices approvingly the proposed system of international exchanges of reports and other agricultural documents, and of field and forest products likely to be suitable and profitable. And under this head he acknowledges the receipt of reports and seeds from this Department, and mentions forty specimens of Australian seeds, and thirteen species of *Eucalyptus*, besides seeds of *Eucalyptus globulus*, (blue gum,) and *E. rostrata*, (red gum,) sent in return.

The volume contains, besides the report of the secretary, the report of the chemist and a report on the state forests. These are followed by papers on agricultural education; on hop-cultivation; on agricultural shows; on worm-diseases in sheep; on the white-eyebrowed wood-swallow, (an eminently useful insect-destroyer;) on flax and flax-machinery; digests of various laws and regulations affecting farmers—all by the secretary of agriculture—and on Victorian grasses; on diseases among stock; on orange-culture; on Australian wood-boring beetles; on the apple, (in which several American kinds are honorably named;) on the meteorology of Victoria; on silk-culture; on the state of agriculture in the Burrumbeet, Dean, and Smeaton districts, by various writers. By the foregoing it will be seen that this report, in its general outline and frame-work, is not much unlike the annual report of this Department.

SIXTH ANNUAL REPORT ON THE NOXIOUS, BENEFICIAL, AND OTHER INSECTS OF THE STATE OF MISSOURI, made to the State board of agriculture, pursuant to an appropriation for this purpose from the legislature of the State. By Charles V. Riley, State Entomologist, Jefferson City. Regan & Carter, State printers, 1874. 8vo, pp. 169.

A good report, creditable alike to its author and to the State which retains his services for its farmers and fruit-growers, and gives the results of his labors in this neat and convenient form to the world; for, at Mr. Riley's suggestion, the board of agriculture has published his report in this separate form. The adoption and extension of this plan by other States might prove economical, as the number of reports of dry "proceedings" might be much lessened, if separate, thus saving paper and press-work.

Mr. Riley, and probably some other entomologists, including the one in this Department, make a curious misapplication of a new term—"insecticide"—which we hope will be stayed before it overflows the analogous words "homicide," "suicide," "infanticide," "regicide," &c. He applies the word to the instrument or thing, instead of the person using it. For the sake of precision in the meaning of words similarly derived, let the analogy of all the "*cides*" be preserved.

In "Notes of the Year," Mr. Riley places supplementary notices of insects previously reported, as the codling moth, the Colorado potato-beetle, the cotton-worm, and the canker-worm, with notes of remedies proposed. Under the heading "Insects injurious to the grape-vine," he brings all the facts previously published and recently ascertained, that the grape-grower may clearly see "all that is known of it at the present time." This portion is elaborately illustrated, and has an appendix giving the different types of the *Phylloxera*, and descriptions of the "true grape-vines of the United States," from the pen of Dr. G. Engelman, pointing out those which best resist insect-ravages, and should therefore be selected as stocks on which to graft the more susceptible varieties. "The blue caterpillars of the vine," comprises previous and late

observations on several species of grape-vine worms. Notices of the red-legged ham-beetle, the clover-hay worm, the legged maple-borer, the raspberry-root borer, the northern brention, and the jumping sumac-beetle, close his report on injurious insects.

But one beneficial insect, the white-grub parasite, is noticed, and two harmless insects, Dominican case-bearer and the Yucca moth.

The report closes with what, from its poetry and warmer style, appears to have been most interesting to its author, and will probably be most so to the general reader—a notice of two beautiful hackberry butterflies, and four species of katydids, with illustrations of course. The latter he considers to be more appropriately named "tree-hoppers" than "grasshoppers," and that most grasshoppers should be classed among the destructive "locusts," where, in fact, they really belong.

The first illustrated "katydid," named the "angular-winged," is the insect very generally known elsewhere as the "stocking-weaver;" the love-notes of the male being very like the continuous or elongated "chirr-r-r-r" of the old common stocking-loom, when forming the "stitches;" and the "chick, chick" of the female, in reply, being like the sound of the change in the loom to form another row of "stitches." So exactly similar are these sounds to those of the loom, that it is hoped that Mr. Riley will hereafter recognize their title to the popular name; especially as he says that "popular names are just as desirable for our better-known insects as for our common plants or larger animals. They have, indeed, one advantage over scientific names, in that they do not fluctuate with every change in classification." It will be pleasing news to many that "these insects make quite interesting pets, and if accommodated with a good-sized cage, will pursue their duties and their pleasures almost as unrestrainedly as if in their native tree-tops. * * * They will sit quiet while their cage is being cleansed and fresh supplies of leaves introduced. * * * I even succeeded in keeping some in a warm room, feeding on apples, up to December 6, 1869, or more than two months after the unhoused specimens had ended their autumn feast and retired to endless rest."

Another is the "narrow-winged katydid," most abundant in Northern New England, with its soft, low note, "zeep, zeep," seldom repeated more than twice in succession. It is not a full substitute for the real "katydid," ("broad-winged,") so abundant in the Middle States, with its love-song of "katydid," in a high, sharp key, followed by "katydidn't," in a gruffer tone and lower key, and presumably by its partner in the discussion.

The descriptive portion of the report closes with description and illustration of the "oblong-winged katydid," when a copious index closes the volume.

The value of entomological knowledge is thus set forth by Mr. Riley, when treating of the *Phylloxera*, the great enemy of the grape-vines of Europe:

The Franco-Prussian war, with all its fearful consequences to France, has passed away. The five milliards of francs ($1,000,000,000) have been paid as indemnity to her victors, in so short a time that the civilized world looked on in wonder and astonishment; yet this little *Phylloxera*, sent over, doubtless in small numbers by some American nurseryman a few years since, continues its devastating work, and costs that unfortunate country millions of francs annually. The last German soldier has been removed, at terrible cost, it is true, from French soil, but the *Phylloxera* army remains; and if another five milliard of francs could extirpate the last individual of this liliputian insect host from her soil, "la belle France" would be cheaply rid of the enemy. Had the world, twenty years ago, possessed the knowledge we at present have of this insect, and of its dangerous power, a few francs might have originally stayed its invasion of that great vine-growing and wine-making country. Needs there any more forcible illustration of the importance of economic entomology?

HOMES, AND HOW TO MAKE THEM. By E. C. Gardner. Illustrated. Boston: James R. Osgood & Co., 1874, pp. 314.

A lively book on a weighty subject, or, rather, a grave subject so treated as to be interesting, sprightly, and even humorous at times. It is in the form of letters between an architect and his friends, Mr. and Mrs. John, who subsequently bring forward their fellow home-seekers—Mrs. John's "sister Jane," and a "schoolmaster," who proves to be the particular friend of "sister Jane," and lastly Mr. Fred and his wife, who are "eastern people westernized." Each, in sundry letters, presents his or her peculiar wants and wishes in regard to a home, its conveniences and adornments, and its size, from two rooms up to a goodly mansion; on various locations, from a side-hill to a goodly elevation, and with or without basement or towers or mansard. All kinds of materials are discussed—stone, part stone and wood, wood, stone and brick, and brick alone. The construction and material of each portion is considered—foundation, cellar-walls and partitions, outside and inside walls, roofs, chimneys and flues, floors, ceilings, and partitions. The arrangement of kitchen and rooms, closets, pantries, &c., is attended to; painting and papering are considered, and warming and ventilation fully discussed. In short, nearly everything that pertains to the security, durability, comfort, convenience, internal and external beauty, cost, economy, and fitness of a home, is treated as fully as can be expected in a volume of this size. As the author says in his preface, "These letters between the architect and his friends are composed of hints and suggestions relating to the building of houses. Their aim is to give practical information to those about to build, and to strengthen the growing demand for better and truer work." He hopes, also, to move his readers "to a more cordial hatred of whatever is false and useless, and love for the simple and true."

His hatred of architectural lies and painters' shams is refreshing in these days of imitations of stone, marble, and grained woods; and the reader can hardly fail to imbibe useful instruction with amusement, as the architect answers the various questions, combats the false tastes and wrong notions, and meets the objections of his correspondents, giving to each the needed information in regard to all the requirements of a good home.

REPORT OF THE CONDITION OF THE SEA-FISHERIES OF THE SOUTH COAST OF NEW ENGLAND IN 1871 AND 1872. By Spencer F. Baird, commissioner, with supplemental papers. Washington: Government Printing-Office, 1873, pp. 852, with maps and numerous illustrations.

A goodly volume, which well sets forth the importance of the "agriculture of the sea" in this terse opening paragraph:

> The importance to the United States of the fisheries on its coasts can scarcely be exaggerated, whether we consider the amount of wholesome food which they yield, the pecuniary value of their products, the number of men and boys for whom they furnish profitable occupation, the stimulus to ship and boat building which they supply, and, not the least of all, their service as a school for seamen, from which the merchant marine as well as the Navy of the country derive their most important recruits.

The decrease of fishes on the coasts that have been long and heavily drained by human demands, is probably dependent on the habits of most if not all fishes to return to the same spawning-places year after year. Of late years the decrease has been more rapid on the coast here

reported, because of the increased population to be supplied; the greater facilities by railways, and in the use of ice for packing, for extending sales into remote sections of the interior; the waste and even reckless destruction of spawn and of fish in endeavors to get the largest supply in the shortest time; the manufacture of oil and manure from fish; and the diminished supply as food for other fishes, thus compelling the feeders to seek other places for feeding.

As a thorough investigation of all these and other points was necessary to a correct result, the inquiries took a wide range. In addition to the above-named causes of decrease, the commission examined into the effects of changes in the temperature of the waters and of pollutions of waters by the waste of manufactories and the sewage of cities; the amount and condition of fish-food; the habits of the fishes, and the diversion likely to be caused in those habits by the changes above noted, and the interference of inventions for fishing. And the products of some of these investigations were also used to add to the collections for the National Museum at Washington, and for other important museums elsewhere.

The conclusions arrived at, as to the proper mode of preventing further decrease, and insuring an increased supply of food-fishes, the commissioner has embodied in an act, (which has been submitted to, and amended and approved by, the best authorities among all parties most interested,) which is to be made a law and enforced by the States of Massachusetts, Rhode Island, Connecticut, and New York. This act is to provide for the prohibition of capturing fish in traps and ponds, from 6 p. m. on Friday until 6 a. m. on Monday—three nights and two days in each week—during the six weeks of the spawning season. This measure, all admit, will allow a gradual increase of the number of all fishes, without material interference with the interests of any persons interested, except, *perhaps*, a few middle-men. Intelligent fishermen gave assurances that they would *gladly* welcome a law to that effect. To secure its easy and certain enforcement, all ponds and traps are to be licensed, and an infraction of the law is to work forfeiture to the State, and a transfer of the license to the informer. This will render official surveillance by the State nearly unnecessary—the law will almost enforce itself.

Should these States neglect or refuse to enact such a law, it is then urged that Congress pass a law absolutely prohibiting "the erection of any fixed apparatus for taking fish, after a period of one or two years, on the south side of New England and on the shores of Long Island, which constitute the spawning-grounds of the shore-fishes referred to." The "one or two years," would allow the present owners to wear out or use up their apparatus; and the absolute prohibition following, would restore the original abundance in much less time than the more gradual measure proposed for State action, while it would leave all fishing open to fishing by hook and line, seines, and gill-nets exclusively. Thus the markets would be more regularly supplied, and the business and its profits be divided among a greater number of persons. Absolute prohibition by the United States is required, that it may be able easily to enforce the law. An occasional patrol along the coast by vessels of the revenue department, to confiscate all apparatus used in violating the law, would be all that is requisite.

There are many other matters of interest in the report, and many valuable papers elicited by the inquiry, but this brief notice of the report proper of the commissioner will suffice to indicate what will meet the reader's attention should he incline to consult the volume itself.

Proceedings of the Florida Fruit-growers' Convention and Association, held at Pilatka, November 10 to 12, 1874. Jacksonville, Fla., office of the Florida Agriculturist, 1874. Double column, large 8vo, pp. 26.

A pamphlet full of needed valuable information, so that large extracts may not be amiss. The convention, held on November 10 and 11, organized a fruit-growers' association for the State, which closed the meetings on the 12th, after choosing Mr. P. P. Bishop, San Mateo, president, and Mr. C. Codrington, Jacksonville, corresponding secretary.

Cotton and sugar, already largely produced in West and Middle Florida, and also in East Florida, were only named incidentally; the discussions turning mainly to the culture of oranges, grapes, and bananas, and the means by which they could be most cheaply and speedily transported to market.

Mr. Means, of Orange Lake, in orange growing, prefers budding, protecting the trees for a year or two on the south side by a stake with a little moss suspended from it, and never lost a tree by cold. His grove is on the west side of the lake, but he thinks the east or south side better. He recommends northwest water protection, but if it cannot be had, then "as high a point of land as possible, as the high lands are less liable to spring frosts than the low lands. He had budded the same tree on the north and on the south side, and the frost had killed the bud on the south side, while the one on the north side had lived. He had never yet seen weather cold enough to kill two-year old trees, and thought that anywhere south of Pilatka one need *never* lose a tree by cold." He advised trimming sparingly, as the leaves served as a protection to the body of the tree, both from sun and frost. As to insects, the remedy is freedom from weeds and grass, and judicious manuring. "No insects were ever found on hardy, healthy trees."

Mr. Strong, of San Mateo, read a paper on Florida and its productions, in which he said, "It is in the line of *fruit* that East and South Florida will mainly operate. In this the *orange is king*, superior to all others, the most hardy, the easiest to cultivate, and the most profitable in its cash returns." He said that Florida is the only section in the Union where it can be grown to any great extent with success; and there is no fear of overstocking the markets, as consumers will increase more rapidly than the supply and facility for cheap transportation to the North and West.

Mr. Bidwell read an essay on grape culture, which is yet in its infancy, but very promising. He has tested forty varieties, and recommends the Hartford, Delaware, Crevelling, Ives, Concord, Rogers, (14, 15, and 19,) and Telegraph, for early; and Salem and Rogers No. 1 for late. He said, "I find an entire absence of mildew on either leaf or fruit, and, with the exception of a few varieties, a remarkable freedom from rot," and thinks that "the time is not far distant when thousands of acres will be devoted to its culture, and the grape will form an important article of commerce." The season for planting is from November 15 to March 1; the soil, high lands, or well drained; if poor soil, manure well with a compost of leaves, muck, rushes, marsh-grass or stable-manure. He prefers stakes to trellis, and does not plant the crown 8 inches below the surface. He plants the Augusta striped melon between the vines, and for the past five years has netted 40 cents apiece on his melons in the New York market.

Of the Scuppernong grape, Mr. Adams said that "a yield of 2,200 gallons wine to an acre had been known," and that "1,000 gallons is a certainty." He prefers the trellis for it and its varieties, and great distances

apart are required. According to Mr. Martin, "vines planted 40 feet apart will cover the whole ground in ten years." Mr. Martin also said, "I do not believe that any one knows when the Scuppernong is fully grown. If it is properly manured and arbored there is no knowing how far it will spread." It ripens a fortnight earlier and makes a better wine than when grown in its native North Carolina.

Mr. Eichelberger, of Ocala, read a paper on growing bananas. His grove is on "the southern exposure of a hill * * protected on all sides by high forest-trees," and some trees left standing in the plantation. (He recommends the *Eucalyptus* as suitable, if a protection of trees is to be grown.) In his grove he planted orange and banana rows alternately. He commenced in 1852, but could raise no fruit. Twelve years after he began again, and sheltered his plants from cold during the winter by wrapping the stems with green moss; the plants became acclimated, and now produce fruit without any protection. If a tender top is nipped, about the 1st of February he cuts it off down to the living center-leaf, which then shoots up, "and if the plant is sufficiently matured it will bear fruit the same year, and no subsequent frosts will injure the plant." He grows three varieties, but recommends the common banana as the best. On the contrary, Mr. Jamison "did not think much of the common banana," except for cooking, and declared "the Martinique is the best variety," but agreed with Mr. E. that "any kind can be cultivated here."

Besides the discussions on fruits, modes of cultivation, protection, gathering, curing, and packing for market, diseases and insects, and their remedies, were also discussed. The orange "blight," (variously termed "die back," "damping off," &c.,) was treated by one individual as caused by an insect, (just as, some years ago, the "black knot" was supposed to be by many at the North,) but Mr. Fowler, of Port Orange, who said he could cause it in almost any case, and had sometimes cured it, declared that the primary cause was unhealthy soil, or bad treatment, producing a tendency to disease; the spores of fungi already floating in the sap took advantage of this tendency, greatly aggravated its development, and then flourished all the more. An "imprudent use of stimulating-manures" was also named as producing "blight." For "die back" Mr. Means would "bud below the place affected, and cut off the shoot above." Probably keeping soil and trees in a healthy condition is the only preventive yet known. The subject is an important one for subsequent investigation.

Naturally enough in a convention of enthusiastic Americans, our Florida friends have pointed out some duties for the National Government in the way of aiding their cause. The following plan is accordingly commended by them to the Commissioner of this Department and to Congress.

Other departments have agencies in the States, and so should agriculture be represented. Hence "a district of —— miles in area" should be located in Florida, with sections "appropriated to the different classifications of the floras"—a vast botanical garden, in short—"a pleasant resort for visitors, as well as * * * useful for us, here at home." Other regions of the Union would require similar representations of their peculiar productions, and thus a number of branches of the National Agricultural Department would be established, where experiments could be tried under more favorable conditions than are possible at Washington; and it was suggested that an orange-grove in connection with the Florida branch could be made to defray its entire cost. As the subject was referred to a committee, a report will probably unfold the whole plan more fully hereafter.

AMERICAN POMOLOGICAL SOCIETY.—Proceedings of the fourteenth session and quarter-centennial celebration. Edited by Henry T. Williams, secretary *pro tem.*, and published by the society.

In compliance with the invitation of the Massachusetts Horticultural Society, the fourteenth session and quarter-centennial celebration of the American Pomological Society was held in the hall of the above-named association in Tremont street, Boston, on September 10, 1873, and the three following days. The meeting was largely attended, as all horticultural, pomological, agricultural, and kindred associations in the United States and British Provinces had been invited to send delegations, as large as they might deem expedient, and to all persons interested in the cultivation of fruits seats had been proffered in the convention. The various societies of the country having also been invited to bring specimens of fruits, nearly the entire available space of both halls of the Massachusetts society was occupied with the overflowing abundance of pomological contributions, so that the convention was forced to meet in Wesleyan Hall, immediately adjoining. Here the assembly was called to order at 10 o'clock a. m., by the president, Hon. Marshall P. Wilder, who introduced Mr. W. C. Strong, president of the Massachusetts Horticultural Society. Mr. Strong briefly addressed the delegates, giving them a cordial welcome to their city, to their homes, and the well-known hospitality of the people of Boston. President Wilder responded, after which he announced the committees on credentials, record of fruits exhibited, and on nomination of officers. The society then adjourned to Faneuil Hall, where a reception was tendered by the mayor of the city. The reception was largely attended, yet informal, and occupied but a brief time. An address of welcome was delivered by the mayor, and responded to by the president of the society.

Mr. Wilder, in the course of his biennial address, delivered during the afternoon session of the convention, thus alludes to the early history of the society:

The idea of a pomological convention appears to have occurred to individuals in different States at about the same time, as new ideas in regard to progress frequently do. Thus, in the summer of 1848, consultation was had with Andrew Jackson Downing, the great American landscape-gardener, and editor of the Horticulturist, then on a visit to the city of Boston, in regard to the chaotic condition of our pomology; the want of accurate and well-defined knowledge of our fruits, whereby correct conclusions could be drawn as to their various merits; the best means for improving the condition of fruit-culture, and the expediency of establishing an American society, so that by interchange of experience and more cordial intercourse, by general consent we might preserve those fruits which were valuable, discard those which were worthless, correct the confused nomenclature, and establish a pomology for our whole country. To establish such a society was a great work, but it was considered as the only means which could accomplish the desired object. A correspondence was immediately opened with some of the prominent agricultural and horticultural societies, and with the leading nurserymen and pomologists of our land. This resulted in the proposal of the American Institute of New York to have a convention held under its auspices in that city. Pursuant to these arrangements a circular was issued, signed by committees of the Massachusetts, Pennsylvania, New Jersey, and New Haven horticultural societies, and the American Institute of New York, proposing to hold a "great national convention of fruit-growers" in the city of New York October 10, 1848. Of the fifteen persons whose names were appended to this call, three only remain. All the rest have joined the great procession of the dead.

The convention met, and the society was organized as the "American Congress of Fruit-Growers," by the choice of Marshall P. Wilder as president, a vice-president from each of the several States represented, and three secretaries. Of these, S. B. Parsons and P. Barry are here to-day.

The first national pomological assemblage, solely for the consideration of pomological subjects, met at Buffalo September 1, 1848, at the call of the New York State Agricultural Society, and after an interesting session resolved to perpetuate itself under the name of the "North American Pomological Convention." But it was plain that there could be but one national organization that could carry due weight. A conference was therefore had, which

resulted the next year in the consolidation of the two associations under the name of the "American Pomological Congress." The first meeting of the united associations was held at Cincinnati, 1850. In consequence of a death in the family of the president, he was absent, and Dr. W. D. Brinckle was chosen to preside, but at the next meeting declined a re-election, and the present incumbent was again called to the chair, which he has occupied to this date.

Its sessions, since the first three, have been held biennially. There have been three in New York City; one in Cincinnati; three in Philadelphia; three, including the present, in Boston; two in Rochester; one in St. Louis, and one in Richmond. The first session in Philadelphia, in 1852, will ever be memorable as the occasion when a eulogy was pronounced, by the person who now addresses you, on Mr. A. J. Downing, one of the chief projectors of the society, whose sudden death had occurred a short time previous. At this session a constitution and by-laws were adopted, and the name was changed to the "American Pomological Society."

In alluding to the progress made in the science of pomology, Mr. Wilder said that but few persons are aware of the great revolution which has taken place in fruit-culture since the establishment of this national association, or of the laborious efforts of the patient pioneers and investigators who have spent their lives in the promotion of the art. Much of the rapid progress made was due to the influence of the agricultural press, now and hereafter to be a great power in the land. There are those now living who can remember when there was not an agricultural or horticultural paper, nor a book on fruit-culture, published on this continent; and many of those present also remembered the time when there were but few apples sent from the western to the eastern coast. Comparing those days of scarcity with the present period of an overflowing abundance of improved varieties of all kinds of fruits, the speaker said:

But who can even estimate the progress of our art; the importance of this industry to our nation? Whose prophetic eye can survey the grand expanse which is to open on our course during the next twenty-five years? Ere that time shall have arrived, much of the unoccupied territory of our country, now greater in extent than that of all our present States, will, by the aid of our transcontinental railroads, be opened to cultivation, and Columbia River, Puget Sound, and the whole Pacific coast, with its untold treasures, be united with us in the great work of promoting the pomology of this land. Give us twenty-five years more, and from ocean to ocean, from the Dominion to the Gulf, our hill-sides shall be clad with the vine, our great valleys adorned with orchards and gardens, and the fig, orange, and olive of the South and Pacific shores shall rival those of exotic growth. Give us twenty-five years more, and our catalogue of fruits shall be filled with native varieties, and dedicated to American pomologists, who, by their labors and benevolent efforts, have contributed to the wealth of our country and the happiness of our people.

In the report of the committee on rejected fruits and synonyms, special attention is called to the importance of the cultivation of a smaller number of varieties, and those of the better sorts. The committee state that during the early period of fruit-culture in this country, a long list of varieties was regarded as a special merit in any collection, and the nursery-man who could present the largest catalogue stood at the head of his profession. This led to the cultivation of many sorts of little value, and it became an object of importance to separate the valuable from the worthless. A great change has taken place of later years, and collections of fruit for profit, as well as for home use, have been reduced to a few select sorts, the amateur and pomologist only desiring a wider range. The lists which are now wanted are of such sorts as the cultivators may plant for use. Rejected lists are no longer inquired for, and the committee is of the opinion that really worthless varieties will, from their own want of value, find their proper level and be forgotten. As to the determination of correct synonyms, the committee give the following list, which was prepared by Mr. Charles Downing:

Boston Pippin is a synonym of Golden Pippin, (p. 195, Downing;) Belle Rose is a synonym of Primate; Conic June is a synonym of Kirkbridge White; Copp's Mammoth is

synonym of Gloria Mundi; Early Baldwin is a synonym of Primate; English King is a synonym of Alexander; Highland Pippin is a synonym of Primate; Lodge's Early is a synonym of Summer Rose; Montgomery Sweet is a synonym of Autumn Sweet Bough; Shelborne Sweet is a synonym of Spice Sweet; Tennessee Early Red is a synonym of Early Strawberry; Whitewater Sweet is a synonym of Wells' Sweet; Yellow May pippin is a synonym of White Juneating; the celebrated Southern Hoover is a synonym of Black Coal.

A very elaborate report on the subject of pear-blight, its cause, remedy, and prevention, was presented by a committee appointed at the previous meeting of the association. The subject is one of great importance, and seems to have been so thoroughly and intelligently investigated that no apology is deemed necessary for giving the conclusions of the committee as they were laid before the convention :

Pear-blight assume different forms, and, consequently, has different causes for its origin. One form attacks trees gradually; its approach is slow and may be detected for months, and often during the preceding season of growth, before the tree is fully affected. This form, which may be termed gradual blight, is seen at all seasons during the period of active vegetation, from early spring until September. The progress is usually arrested by a liberal top-dressing of liquid manure, so far as the roots extend, and a severe cutting back of the branches. This must be done whenever the tree assumes an unhealthy appearance. The cause, then, may be safely attributed to exhaustion, and the remedy consists in replenishing the exhausted supply of plant-food. This form of blight is often noticed in orchards left unworked, and where the annual or biennial top-dressing with fertilizing agents has been withheld.

Another, and this is the most fatal form, attacks a tree or a portion of it, suddenly, causing the affected part to blacken in a few hours after the tree is struck. This is commonly termed fire-blight. This form is periodical in its attacks and migratory, as it seldom remains permanent in a locality, but leaves an interval of from ten to fifteen years between its occurrences. The greatest intensity is on its first appearance, which occurs usually when the fruit has attained half of its size. It decreases as the season of vegetation advances, but re-appears again the following summer with less of its previous intensity. After decimating a section of country during two consecutive seasons, there will be an interval of a series of years during which blight in its other forms may occur, but there will not be a wholesale destruction, as during the prevalence of epidemic blight. Every observation tends to the conclusion that fire-blight is caused by zymotic fungus, whose presence is not detected until life is destroyed in the affected parts. This form offers a wide field for the investigations of microscopists, and from their future labors we hope to arrive one day at the origin of this fungoid growth. * * Boiled linseed-oil applied to the trunk and limbs has been tried near Norfolk, Va., with marvelous cures, as reported. We mention this instance of the use of an extraordinary ingredient, resulting in good effects, as contrary to what is usually the result when using this application on the body of trees, its effects being to seriously injure the tree, if it does not destroy it.

Still another form of blight is doubtless caused by mechanical actions, by the rupture of tissues consequent to a sudden superabundant flow of sap. This attacks only our most thrifty-growing trees, either in early spring, when vegetation first becomes active, or after a period of drought and partial stagnation of vegetation, when abundant rains suddenly force out a luxuriant growth. Moderately-vigorous trees are never attacked. It is often noticed in very vigorous trees that the bark of the trunk is split longitudinally. Whenever this is apparent such trees are always free from this form of blight, as the pressure upon the cellular and vascular tissues has been relieved. From a series of experiments, commenced in 1857, it is demonstrated that trees whose bark had been longitudinally incised and divided never showed any signs of this form of blight.

Peculiar methods of culture undoubtedly influence the causes of blight, but upon this there exists a wide range of opinion. Clean culture and repeated stirring of the soil, while it may in many instances be conducive to most beneficial results, will often cause a total destruction of a pear orchard. In seasons of zymotic fungoid or fire-blight highly-cultivated trees fall early victims to the scourge, while those cultivated in grass, with an annual top-dressing of manure, usually escape the contagion.

The third form of blight, caused by mechanical action, is seldom found in orchards where the soil is left undisturbed, but is so common in gardens, or where the trees are thoroughly worked, that it has become only a question of time for the entire destruction of one's orchard.

In the Southern States this form of blight is the most destructive, as it has become epidemic to all highly-cultivated soils. Whenever the land is allowed to become coated with grass or weeds, but kept cut down every few weeks and an annual top-dressing of manure is applied, the result has been most satisfactory, in an abundant crop of fruit and an almost entire freedom from blight.

In an essay read before the convention by Mr. T. P. Quinn, on the subject of the exhaustion of fruit-trees, the writer states that the fail-

ure of certain varieties of fruit to bear maximum crops of well-developed specimens every year, or even every alternate season, does not prove that such a variety is worthless and should be placed among the rejected fruits, for with similar treatment this same variety, grown upon a different quality of soil in another locality, would yield abundantly of full-sized fruit. Failures arising from uncongeniality of soil and climate are strikingly numerous in every district where fruit-growing has been attempted in this country. These failures, Mr. Quinn thinks, are mostly due to an exhaustion of the soil, and not to an exhaustion of the tree itself. The market-gardener who raises one, two, and even three crops from the same piece of ground during one season, succeeds only by means of a liberal use of fertilizers. Fruit-trees require nourishment as well as vegetables, and if the soil is exhausted of those qualities necessary to sustain life and produce fruit, they must not only become barren but eventually die if the proper food is not administered. Especially in pear-culture exhaustion and premature death of certain varieties are hastened by neglect in furnishing the soil with necessary fertilizing material, and allowing young trees to overbear. In the opinion of the writer this latter practice has permanently injured more pear-trees than all the other causes combined, and he thinks it cannot be too strongly condemned. Still another and very prolific source of exhaustion is in planting fruit-trees too far apart. On this point Mr. Quinn says:

When apple-trees, for instance, are set 40 feet apart each way, and pear-trees 25 feet, there are wide intervening spaces between the trees, that, under the most favorable auspices of high culture, it will take at least a quarter of a century for the trees to shade and occupy the whole of the ground. Five or six years from the time of planting such an orchard, the old custom was, and by the way it is very common now, to sow the orchard down to grass, and keep this part of the farm in permanent meadow. In open ground, meadow is seldom left longer than four or five years without breaking up the sod, cropping for two or three more, and reseeding. But owing to the inconvenience of plowing among trees, and the uncertainty of getting hoed crops to grow in the shade of such, the sod in the orchard is left unbroken five, ten, and twenty years. In these long terms, the more nutritious and better quality of grasses are gradually run out, and replaced by the more vigorous and inferior native sorts, much more formidable rivals in the contest for food than the former occupants—a fact that tells its own story from year to year in the starved appearance and unfruitfulness of such trees. However, the crop of hay is cut annually, and hauled to the barn, and the apples gathered and taken away, while there is nothing returned in the shape of manure to make up, in whole or in part, for this annual drain upon the soil. Within my own compass, I know of dozens of apple-orchards that have been kept constantly in grass from twelve to twenty years, the grass cut and apples gathered, (when there were any to gather,) and to my knowledge there has not, within any five years, been enough manure applied to raise one crop of potatoes, nor, during that time, as much labor given to the trees as would be given to raising a single crop of corn. Yet these very men, who are excellent grain-farmers, will stand and wonder why it is that apples don't grow and bear as they formerly did when they were boys, and that there is no use in trying any more. Grass is bad enough, under the best treatment, in an orchard where manure is applied to the surface in liberal doses at regular intervals, but when this part is neglected, or overlooked, for a term of years, it will need no prophetic vision to foresee the final result. Meager crops of very indifferent fruit will be the sum total of such treatment. * * * To make fruit-culture pay the highest profit, I am thoroughly convinced of the importance of close planting, and low heading, so that when they reach the bearing-age the ground will be exclusively given up to the trees. Manure should be applied regularly, and the surface kept under the plow, running this implement, among bearing trees, not deeper than two or three inches.

Mr. G. W. Campbell, in an essay contributed by him on the subject of grapes, speaks very highly of the Lady grape, a new and hardy variety originated near Zanesville, Ohio. It is a pure Concord seedling, and in habit of growth and foliage is scarcely distinguishable from its parent. It is also regarded as equal in vigor, health, and hardiness. Color, light green—would be called white—bunch, rather less than Concord; size of berries fully equal. In quality, rich and delicate, without hard pulp, and scarcely a trace of foxiness. Ripens very early—ten days or more

before Concord. It is regarded as a most promising, perfectly hardy, and healthy white grape, and will no doubt soon hold a prominent position among the most popular native varieties.

Mr. Campbell states that he has discovered, as the result of a number of experiments extending through a long series of years, a method whereby he can determine the character and flavor of seedling-grapes before they came into bearing. He seems to be so thoroughly convinced of the correctness of his theory that the following brief extract in explanation of the discovery is given with the hope that it will lead to further experiments on the part of the grape-growers of all sections of the country:

Repeated and unvarying tests have so far convinced me of its entire correctness, I do not hesitate to announce that in the taste or flavor of the green tendrils of the vine may be found a true index of the character of its fruit. Although this is something that cannot be exactly defined, or accurately described, it may be acquired by any one with a nice, discriminating taste. Go into a greenhouse where foreign grapes are growing, and taste the tendrils of the Muscat-flavored varieties, and of the Black Hamburg and Chasselas, and you will soon learn to distinguish the difference, which is as distinct as the flavor of the grapes themselves. Again, taste and compare the flavor of the tendrils of Concord and Hartford Prolific with those of Delaware, Allen's Hybrid, and Iona. You will find, in each, distinctive differences suggestive of the character of the grapes. Then test and compare the native wild grapes, the fox and frost grapes of the woods, with the tendrils of our cultivated varieties, and you will soon learn easily to distinguish the wild from the cultivated.

From an essay read by Dr. J. Strentzel, of California, on the cultivation of the fig in the United States, the following brief extracts are taken:

The fig thrives best in a rich, mellow soil, well drained if necessary, but kept moist by irrigation if the rain-fall is deficient during the growth of the fruit; thus, in judiciously selected and sunny locations, it will perfect its fruit; also, through the extent of our Eastern States, although it will require shelter during the winter months. It is propagated from cuttings of the previous year's growth, or from sprouts from stool-plants, or around the butt of a tree; these are partially rooted already, and will make a fine growth during the first season, and begin to bear the year following. To avoid the extension of naked, unproductive branches, the tree will require at once considerable shortening in of the shoots, to produce close-jointed wood with abundance of leafy spurs. This very facility of the propagation appears to be a barrier to its further improvement, and the production of new and choice varieties from seed; but the hope in progression in this interesting science is full of vitality, and considering the great difference in the quality of the fruit, and even in the growth of trees of the same variety, when raised under a southern sun and favorable conditions, we are justified in anticipating the production of superior seedlings.

The fruit forms in the axillæ of the leaves; the first crop ripening during the months of June and July, is on the previous year's growth; the so-called second crop is developed with the new growth of wood during the season, and is checked only by want of moisture in the soil, or the autumnal frosts. The fruit-buds requiring from eight to twelve weeks to ripen, furnish a criterion, according to the climatic peculiarities of the different sections of the country, when this late fruit, subject to be winter-killed, should be removed to produce in its place a more abundant and early-ripening crop the next season. The ancient practice of applying a drop of olive-oil to the eye of the fruit I consider more serviceable in repelling insects than to the ripening of the fruit, or to its growth.

The report closes with the admirably arranged catalogue of the society. The arrangement of the names of varieties in this catalogue is alphabetical and according to the nomenclature adopted by the society. Synonyms are given in a few instances where it seemed necessary, and these are placed under the adopted names in italics. The State or district in which a fruit is recommended for cultivation is designated by a star, (*,) and if the variety is of great superiority and value, two stars, (* *;) if new or recently introduced and promising, by a dagger, (†.)

DONATIONS TO MUSEUM.

Name.	Residence.	Articles.
John White	Washington, D. C	Specimen of fiber of musa.
J. A. Johnson	Beaufort, S. C	Silk cocoons.
W. Spillman	Enterprise, Miss	Okra fiber.
Henry Erni	Basle, Switzerland	Silk samples in variety.
Z. D. Gilman	Washington, D. C	Preparations of cinchona, &c., from Powers & Weightman, Philadelphia.
Captain C. G. Penney	U. S. A	Montana -grass; reptiles.
J. P. Lawrence	Scyene, Dallas Co., Tex	Jack rabbit skin; snake rattles.
Mrs. D. V. Nelson	Saint Albans, Vt	Cluster of eight butternuts.
J. C. Herron	Washington, D. C	Palmetto palms, and paper.
Wm. Putchett	Frankfort, Mo	Wool, sample.
Dr. Wm. Baxter	Wappengero Falls, N. Y.	Seedless apples.
C. L. Gould	Hamilton, Mo	Double and triple peaches.
David S. Turner	Washington, D. C	Lycoperdon.
F. J. Gramlich	Hyattsville, Md	Fine poultry.
Jas. Newman	Columbia, S. C	Cocoons of cecropia.
Allen Dodge	Georgetown, D. C	White blackbird; black-breasted plover.
Henry M. Jones	Hartford, Pa	Maple-sugar.
Thos. E. Waggaman	Washington, D. C	Curiously-shaped egg of Leghorn fowl.
Andrew Haltzworth	Petersburgh, Pa	Seven-headed wheat.
John B. Cauin	Live Oak, Fla	Rust-proof oats, fine.
Theodore A. Lay	Norway Farm, D. C	Six to seven head maize, in a cluster.
N. J. Coffin	Washington, D. C	Double orange.
Mrs. A. S. Caldwell	Washington, D. C	Wool, sample.
F. W. Keeler	Mayport, Fla	Collections of insects.
——— Riley		Southdown wool.
Dr. W. W. Anderson	South Carolina	Trap-door spider and nest.
Wm. Davison & Co	Baltimore, Md	Paris green, pure.
James & Wm. Sangstor.	Washington, D. C	South American tarantula. (?)
W. J. Cowing	Department Agriculture.	Petrified wood from Tiber Creek sewer.
Wm. D. Riley	Philadelphia, Pa	Traps for the Colorado potato-beetle.
Powers & Weightman	Philadelphia, Pa	Specimen of economic products, principally medicinal, such as nux-vomica, opium, &c.
C. M. Smith	Washington, D. C	Bunch of fourteen tomatoes.
Miss Moulton	Washington, D. C	Three-tailed gold-fish.
B. K. Bliss	New York City	Potatoes and beets to model.
B. F. Bingham	Washington, D. C	Grasshopper injuries from Kansas.
Wm. Menoval	Matanzas, Cuba	Large calabash.
James A. Ingram	East Bradford, Pa	Large corn.
Horace Morton	Detroit, Mich	Fine wool sample, Germany.
Mrs. A. Hoard	Galveston, Tex	Salt specimen.
A. H. Boies	Hudson, Mich	Cotton.
John Cecil	Mount Vernon, Mo	Mycelium of a fungus.
Smithsonian Institution.	Washington, D. C	Insects, plants, and general natural history specimens, economic specimens, &c.

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